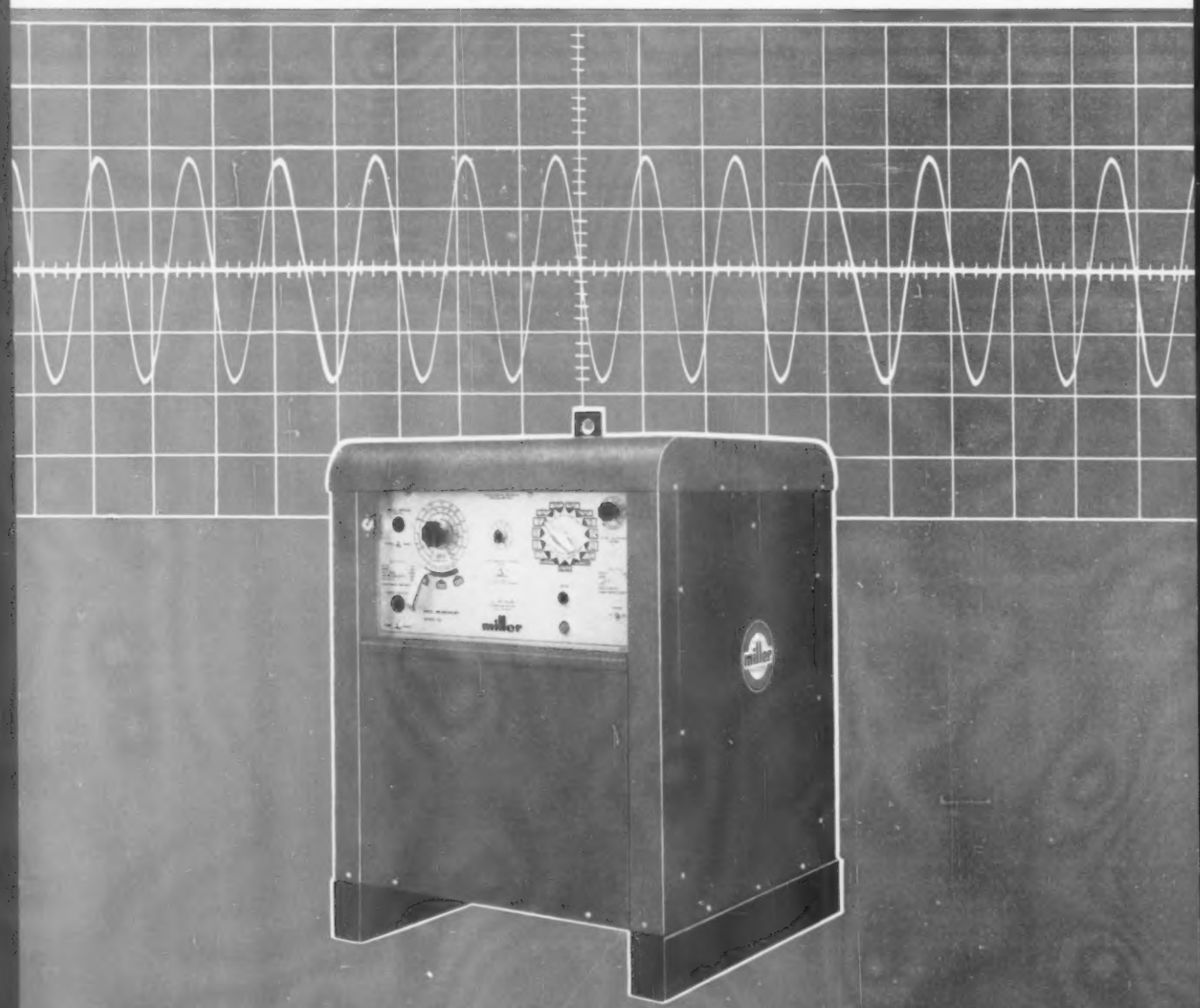
Welding Engineer

PRICE 50 CENTS

NOVEMBER, 1958

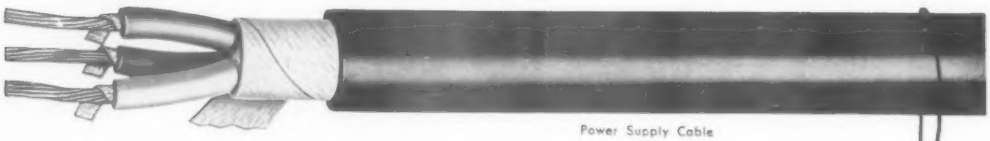


NEW MILLER BW ELECTRIC CONTROL WELDER

miller
ELECTRIC MANUFACTURING CO., INC.
APPLETON • WISCONSIN

This new Miller development improves quality, speed and range of tungsten inert gas welding in all automatic fixture and manual applications. Balanced wave (BW) characteristic results from a new Miller balance control which eliminates the d-c component present in most welding currents. Output of the Miller BW welder is ONLY pure a-c — brings out BEST in TIG welding.

If it's worth engineers' time...



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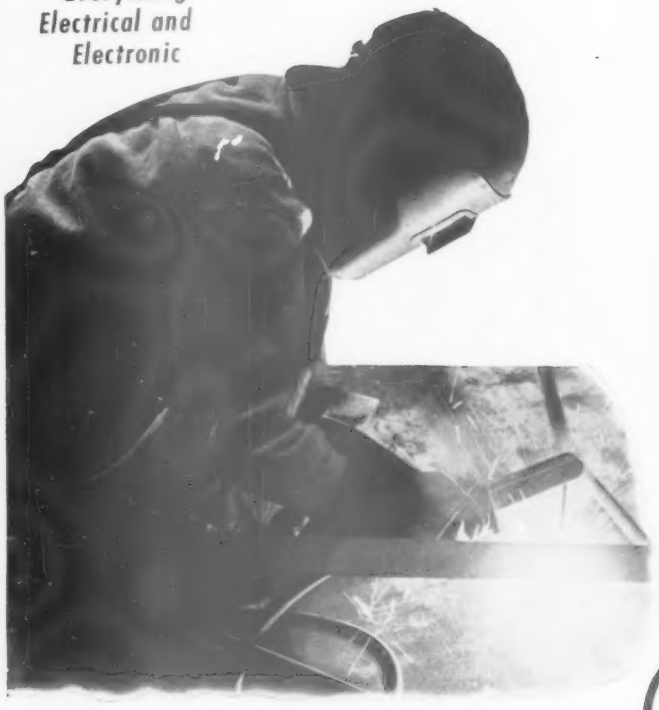
One Wire Source for Everything Electrical and Electronic



Belden
WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

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Welding Cable • Electrical Household Cords • Electronic Wires • Automotive Wire and Cable

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BIG PRODUCTION SAVINGS

with **HOBART'S** NEW
Air-cooled **MIGARC** *gun*

USERS REPORT PRODUCTION SPEEDS INCREASED TO 200" PER MIN. . . . AND MORE!

Hobart's Migarc process is a gem of operator convenience, simplicity and low cost. With it you can attain radically increased production speeds on mild steel welding.

This newest and most advanced method of metal-inert-gas shielded arc welding features three Hobart components: a constant voltage power source, an automatic control and wire feed, and an extremely simplified gun.

Three models of the CV power source provide 500, 900, and 1200 amps respectively on a 100% duty cycle at 3 to 48 volts. The control eliminates troublesome, delicate, costly gadgets. Its wire feed mechanism is extremely powerful. The gun is air-cooled, enabling the operator to work unencumbered by heavy water lines, or leaky connections. Inexpensive CO_2 is used for the shielding gas.

Here's just one of many good examples where Hobart's Migarc process greatly increased production.

Parish Pressed Steel, a division of Dana Corporation in Reading, Pa., fabricates auto frames. The trend to lower bodies, hardtops, and no center pillars demanded more box sections per frame. Weld inches soared. The cost of adding manpower and conventional welding equipment to handle the increase was prohibitive and impractical. Hobart's Migarc process was the answer. According to J. W. Holzman, Assistant Chief Engineer for Parish, it solved the majority of their problems.

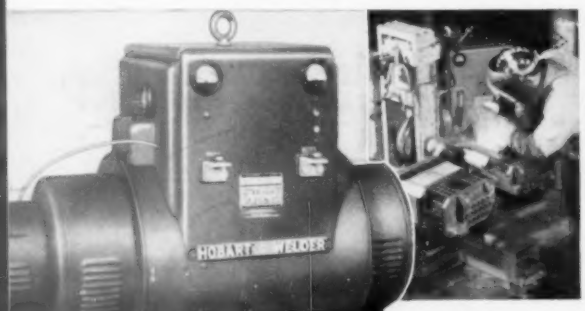
It will pay you to get complete information on Hobart's Migarc process. Do it today while the thought is still fresh in your mind. No obligation, of course!

New HOBART air-cooled gun simplifies operation

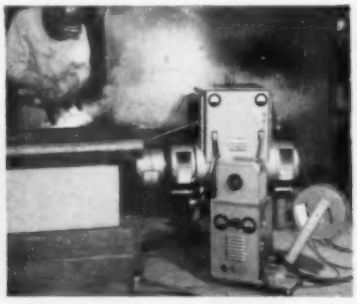
All connecting leads extend from back of the gun. Cables are secured by twist-lock connectors.

The nozzle housing can be easily removed by hand without taking gloves off. An ordinary wrench turns hex nut to remove the nozzle.

One-half turn separates gun from gun end. The operator can easily and quickly make wire feed corrections without removing gloves, or using special tools.



Perfect low cost simplified setup for CO_2 welding: "Powromatic" cv power source, and control wire feed Migarc unit.



Hobart's Migarc process is versatile. It can be used in many locations to suit any application. The gun, control and wire feed unit can be separated, then stratigically mounted for single station operation (above left photo), or they can be used where portability is a necessity (photo above right).

HOBART BROTHERS COMPANY, BOX U-118, TROY, OHIO, Phone FE-21223

"Manufacturers of the world's most complete line of arc welding equipment"

Find Your Nearest Dealer in the 'Yellow Pages'

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☐ Please send me complete details on how Hobart's Migarc process can increase my production. Also include data on:
☐ "Powromatic," ( ) 500, ( ) 900, ( ) 1200 amp. size ☐ Migarc control, wire feed unit
☐ Automatic Submerged Welding ☐ Semi-Automatic Arc Welding

Position

Name

Firm

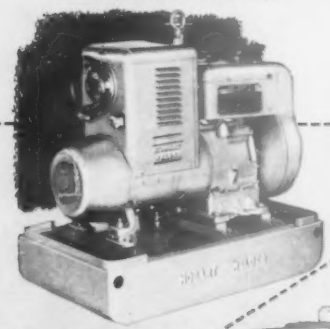
Address Zone State

City

There's MORE actual profit for you when you use these new HOBART WELDERS *with the built-in extras*

Gas Engine Drive, 250 to 800 amp. capacity

Electric Motor Drive, 200 to 600 amp. capacity



"Husky Boy," lightweight, air-cooled, 200 amp. capacity

AC Transformer 180 to 500 amp. capacity

AC/DC Welder Combination

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- Choose the right size and model for the job from the largest and most complete line of manual and automatic welders on the market today—AC, DC or AC/DC combinations—Gas, Electric or Transformers. Select the welder to fit your particular job and be assured of top performance that results in greater economy and faster more profitable production. Check the coupon for the latest specifications on the new Hobart Welders, no obligation.

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Automatic Welding Head has simplified controls for use with CV (constant voltage) welder. No costly, complicated installations.

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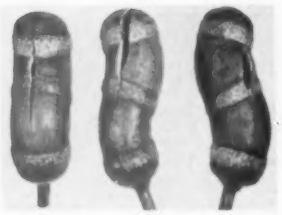
Vol. 43 — No. 11

Welding Engineer

The magazine of joining and severing materials

This is welding: November, 1958



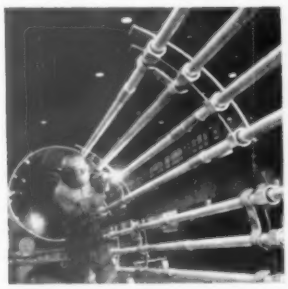
Arsenic's effect on mechanical properties of welds in mild steel 32
D. Canonico and **H. Schwartzbart** present results of an investigation to determine the arsenic content of welding fittings made from British and American steel, and this element's effect on welds in these fittings.

Fundamentals of welding engineering 36
In this third article in a series, **T. B. Jefferson** details the 37 accepted welding methods now used by industry and explains the basic features of each.

Mexico is on its way UP in the world of welding 38
Eric Holby reports extraordinary Mexican progress in welding equipment and supply production, in new constructions with extensive use of welding, and in weldor training programs.

Stress relief by-passed on ship 41
An aircraft carrier's steam receiver had to be repaired despite a lack of time and equipment. Welding engineer **Grover A. Hughes** tells how the problem was solved.

Faster . . . and faster, thanks to Tig and Mig 44
These two modern welding processes, plus Tig cutting, have contributed some remarkable time and labor savings in the fabrication of aluminum railroad tank cars.



Condensers "woven" in 4 steps 46
Here is another report on welding's behind-the-scenes contribution to everyday living, this time dealing with the most recent advance in resistance welded refrigerator condensers.

Foresee wider scope for CO_2 welding 48
New horizons for carbon-dioxide Mig welding are seen with introduction of reactance unit that will permit use of lower currents on mild and stainless steels, as well as on aluminum.

Also in this issue:

A message to management 31
Gulliver-size machinery 43
New York harbor gets 29 welded barges 52
Diagnosis: wear, R—hardfacing 54
Ultrasonic production welder introduced 57
Welding saves farmers 70% 58
Lazy susan electrode container developed 62
Stand-Out Service 65

Regular **WE** features . . .

News 7
Your WeldWorld at press time 15
Between passes 23
Letters 26
Editorial: *Your stake in welding* 29
Welding Clinic: *Dangers of carbon tetrachloride* 60
Data Sheet: *Tips on brazing* 67
New products 70
People 88
30 years ago 91
Free literature 92
The Welding Shopper 93
Advertisers in this issue 94
Literature offered in ads 94
Welding Info-Aids 95

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Introducing...

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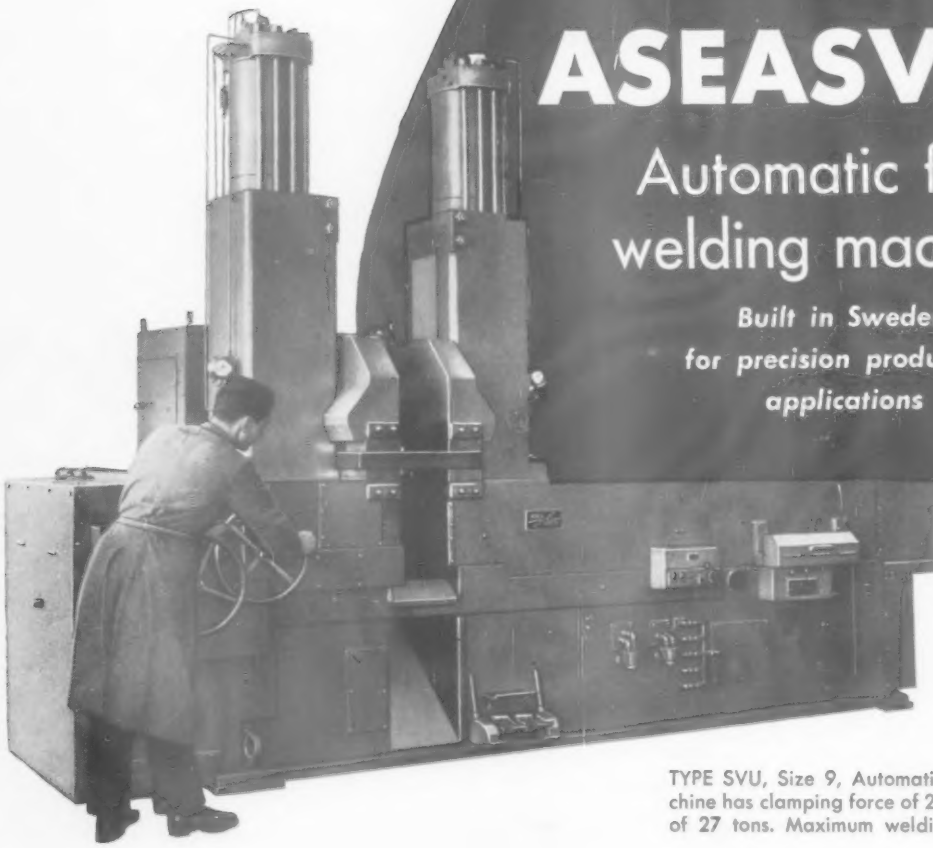
Automatic flash welding machines

Built in Sweden for precision production applications



TYPE SVU, Size 9, Automatic Flash Welding Machine has clamping force of 20 tons, upsetting force of 27 tons. Maximum welding section 25 sq. in.

Known abroad for their precision performance, ASEASVETS Type SVU Automatic Flash Welding Machines are now available in the United States.

Highly adaptable Type SVU is equipped with hydraulic clamping and motor-operated upsetting and has maximum welding section capacities of up to 40 sq. in.

Automatic control, operated through weld temperature and slide distance, permits predetermination of exact welded length and maintains uniformity of welds when abutting surfaces are uneven.

Machines are available for special purpose applications. They also will be designed to meet your particular needs.

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Welding Engineer

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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convert the **total** fluxed portion of electrodes into **weld metal.** **Reduce stub waste to the lowest possible...** which means **DEPOSITED WELD METAL COSTS YOU LESS,** 15 to 20 percent less, when deposited with SHORTSTUBS!

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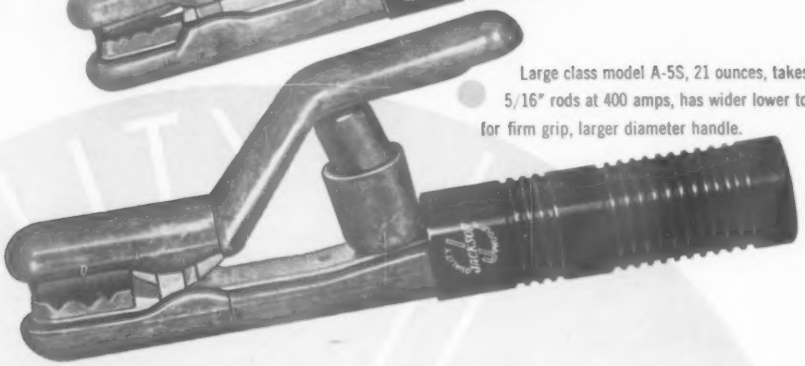
Contact your local distributor

Medium-class holder, model A-W, 14 ounces, lightest holder made to take 1/4" rods, rated 300 amps, with its long lever, and fitting the hand like a glove, is the most popular in the Jackson line.



Large class model A-5S, 21 ounces, takes 5/16" rods at 400 amps, has wider lower tong for firm grip, larger diameter handle.

ORIGINATED and PIONEERED by JACKSON

Featherlight Electrode Holders have been popular since 1944

- Aluminum alloy tongs for lightness, save up to 35% in weight.
- Copper-alloy jaws for durability, are inexpensive, easy to replace.
- High impact, high heat resistant insulation gives you long, trouble free service, low-cost maintenance.

Featherlight

Medium-class streamlined model JH-3, 15-3/4 ounces, takes 1/4" rods into the tight spots at 300 amperes.

Small-class model JH-2, 9-1/2 ounces and only 8" long (Jackson's smallest) takes 5/32" rods at 200 amps.

Sold World-Wide—through Distributors and Dealers

JACKSON PRODUCTS • WARREN, MICHIGAN

Air Reduction Sales Co., A Division of Air Reduction Co., Inc.

DISCUSSING Worthington Co. trademark are (L. to R.) T. J. Kehane, vice-president—marketing; H. C. Ramsey, board chairman; and Walther H. Feldmann, president.

73 year old Worthington trademark dropped; new one introduced

The 73 year-old winged trademark of the Worthington Corp., Harrison, N. J., has been dropped by the company, and a new one is now adorning its products.

Before the old mark was dropped extensive research was carried on to determine how valuable it was. Out

of 200 mechanical engineers polled, an average of 9 out of 10 failed to connect the old mark with the Worthington Corp.

These results prompted experimenting with a new design for the mark. The one chosen is said to be 75% more visible and more symbolic of the company.

New manual covers aluminum welding

Instructional information designed to train and qualify one for inert-gas aluminum welding is presented in three sections in the "Weldor's training manual," by Kaiser Aluminum & Chemical Sales Inc.

The first section of the 144-page book covers essential factors about Tig and Mig welding. Descriptive data about aluminum alloys and their characteristics associated with welding are included.

The last two sections of the book offer step-by-step exercises to follow in order to become proficient in aluminum welding. Twelve exercises are devoted to Tig welding and 11 to Mig welding.

The book may be obtained free if requested on a company letterhead, or can be purchased for $1 from Kaiser, 919 N. Michigan Ave., Chicago 11, Ill.

Lincoln awards to young farm mechanics

The James F. Lincoln Arc Welding Foundation, Cleveland, has awarded $7,000 to 106 young farmers and high school students studying shop mechanics for their entries in a welded shop projects competition.

The awards are made on the basis of usefulness and quality of the project. To enter, the farm boys must make a welded shop project of their own and send a written description of it to the Foundation.

A spokesman for the Foundation said that the projects and entries indicate that the modern farm youth receives well rounded training in mechanics as well as arc welding.

Gerald Riddle, Mead, Wash., received the $600 first award for a hay conveyor. Curtis Gardner, Miltonville, Kan., received $400 and second place for his entry, a welded drill press. The schools attended by each of the students honored received money equal in amount to that received by the boys to improve their shop courses.

NEWS

Inco test plant withstands "Helene"

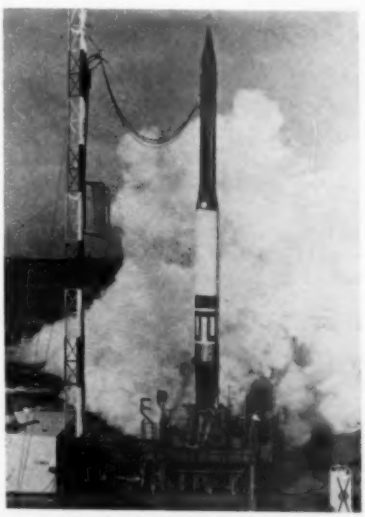
Hurricane Helene did little damage to International Nickel Co.'s Kure Beach-Harbor Island testing station near Wilmington, N. C.

Though small damage was sustained, nothing serious enough to halt testing operations occurred. Tests are being made to determine the behavior of sea air and salt water on materials. The nearly 50,000 specimens include metal, wood, plastics, paint and cordage.

Burdett begins operations in new Columbus plant

Operations began recently in Burdett Oxygen Co.'s new Columbus plant for the production of liquid and vaporous gases. The plant is an addition to the Columbus area distribution services previously carried on by Burdett.

The plant will be able to supply oxygen, nitrogen and argon in liquid and gaseous forms, and acetylene, hydrogen, carbon dioxide, helium and pyrolene. A line of welding equipment and accessories will also be carried by the plant. Burdett is also equipped to supply high purity medical gases.



IF trouble should develop at launching of Vanguard missile at Cape Canaveral, Fla., a fog nozzle system automatically drenches platform with a protective spray. Tube Turn fittings were used for the nozzle system because of the compactness of the platform. The fittings provide leak-proof joints and short radius changes in direction. The system supplies a combination of 80F water and air to the nozzles.

ARTIST'S drawing of building-in-a-building in Union Dome, Baton Rouge, La. Inset at bottom is sketch of location of inner structure which is set slightly off-center inside main dome.

Union dome to enclose small dome

The huge dome being built to house the railroad repair shop of the Union Tank Car Co. in Baton Rouge, La., will also house a smaller, seven-story geodesic dome.

The second dome will provide administrative offices, employees' quarters, materials storage space and a control tower for operation of the dome. The inner building will be 80 ft high, 100 ft in diameter and make 7,500 ft of floor space available. The main dome and its smaller dome are of welded steel construction. (See pages 42-43, Oct., 1958, WELDING ENGINEER)

ASME elects Warren new president

The American Society of Mechanical Engineers, New York City, has elected Glenn B. Warren president. Warren is vice president and consulting engineer of the turbine division, General Electric Co., Milwaukee.

Mexican gas firms affiliated with NCG

Construction of Mexico's first liquid argon plant has been started by Argon de Monterrey, S. A., one of the five industrial firms in which National Cylinder Gas International, Div. of Chemetron Corp., Chicago, recently purchased interest.

The installation at Monterrey, a steel industry center, will also produce liquid oxygen and nitrogen. Production is slated for early 1959.

Electrodos Monterrey, S. A., manufacturer of welding electrodes and gas welding wire as well as acetylene and oxygen gases is another firm in which NCG purchased interest. Other new affiliates are Cia. Productora de Oxigeno, S. A., Monterrey, and Oxigeno de Chihuahua, S. A., Chihuahua, both producers of oxygen and acetylene.

The fifth of NCG's new affiliates is Gases y Electrodos, S. A., with branches in Torrean, Guadaljara and Culican. This firm will market the products of the other companies.

Linde to build western gas plant

Groundbreaking ceremonies for a new Linde Co. liquid oxygen and nitrogen plant at Pittsburg, Calif., were held recently.

The plant, being built on 32-acres, will produce 300 tons of liquid oxygen and nitrogen daily when it goes into operation in 1960.

Norman Harris will be operating superintendent of the plant, the first section of which will be in operation in mid-1959.

A unique feature of the plant is that all equipment has been designed to operate outdoors, which is said to be a radical departure from the normal procedure of producing liquid gases.

Two day weld institute to be held Nov. 11-12

A two-day institute on metals and how to weld them will be conducted Nov. 11-12 at the University of Minnesota. Fundamentals of welding metallurgy, recent developments in welding and design for welding will be stressed.

Some of the topics to be covered are the use of T-1 steel in structural fabrication, functions of electrode coating and recent developments in welding aluminum.

Convention chairman, speaker set for NOIMA

Charles C. Graham, secretary-treasurer of the National Ornamental Iron Manufacturers' Association, has been chosen chairman of the Association's convention to be held Jan. 9-10, 1959, in Atlanta.

More than 500 independent ornamental iron firms are expected to participate in the convention, trade show and exhibit to be held in conjunction with it.

Georgia's Governor Marvin Griffin will give the welcoming address to the convention.

50 Canadian weldors qualify as inspectors

Fifty of the 163 weldors who participated in the Canadian Welding Bureau's home study course on Weld-Quality and Inspection passed the examinations and will receive their diplomas.

The course was designed when the Bureau decided that increased use of welding in Canadian industry dictated a need for trained inspectors to check weld quality to insure their

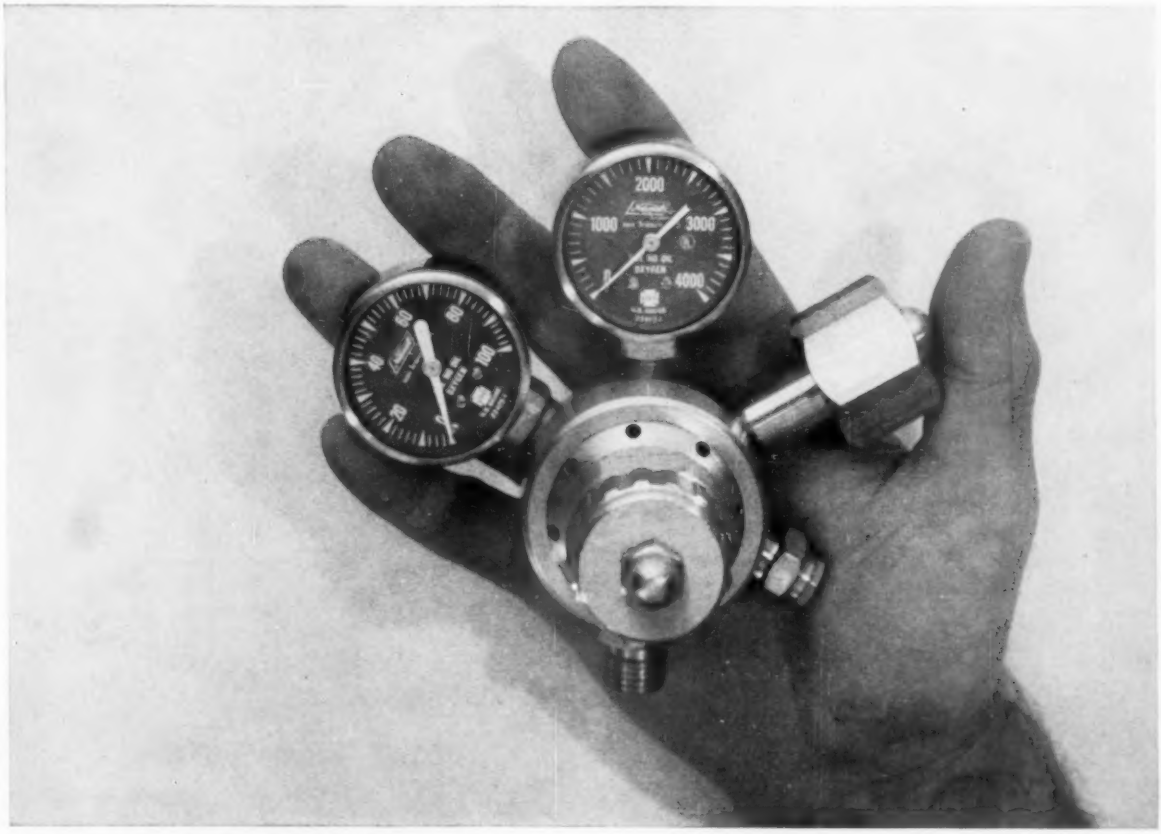
(Continued on page 32)

AMONG exhibitors at the recent Iron and Steel Exposition in Cleveland were American Messer Corp. and Linde Co. Show was held Sept. 23-26 in conjunction with Association of Iron and Steel Engineers' convention. Messer machine demonstrated was Auto-BSW for automatic oxygen cutting of hot or cold billets and slabs with flying start. A welding paper, "Cyclic welding methods salvages heavy mill equipment," was presented at the convention by R. L. Rectenwald, president of Maintenance Engineering Corp., Pittsburgh. Rectenwald has authored many articles published in WELDING ENGINEER.

The NEW Cadet Regulator

small, sturdy, efficient and safe . . .

	Model	Gas	L.P. Gauge	H.P. Gauge	Gauge Color
Cadet	701	Oxy.	100#	4,000#	Green
Cadet	703 (POL)	Acety.	30#	400#	Red
Cadet	703 (Comm'l)	Acety.	30#	400#	Red



Supplementing the wide variety of pressure reducing devices made by NATIONAL of California is this additional set of small diameter regulators available for all cylinder gases. Machined entirely out of sturdy and dense brass bar stock to insure maximum strength and lasting quality. These regulators are equipped with brass gauges, 1½" in diameter, with screw-on glass retainers. The gauge dials are colored to identify the gases for which they are intended. Pre-set adjusting feature enables operator to set regulator for maximum desired delivery pressure. Durable adjusting screw is machined from Duronze bronze to eliminate thread galling. All internal working parts are interchangeable in all Cadet regulator models. Sintered bronze filters prevent the entrance of foreign matter. Self-reseating safety relief valve (other than for acetylene) affords tamper-free safety. Internal design and material used preclude spontaneous combustion. Stainless steel diaphragms with Nylon gaskets and Neoprene seats are for long and trouble-free service life. Delivery capacity meets every normal requirement. Here is a regulator which fully maintains the high standards for which our products are renowned.

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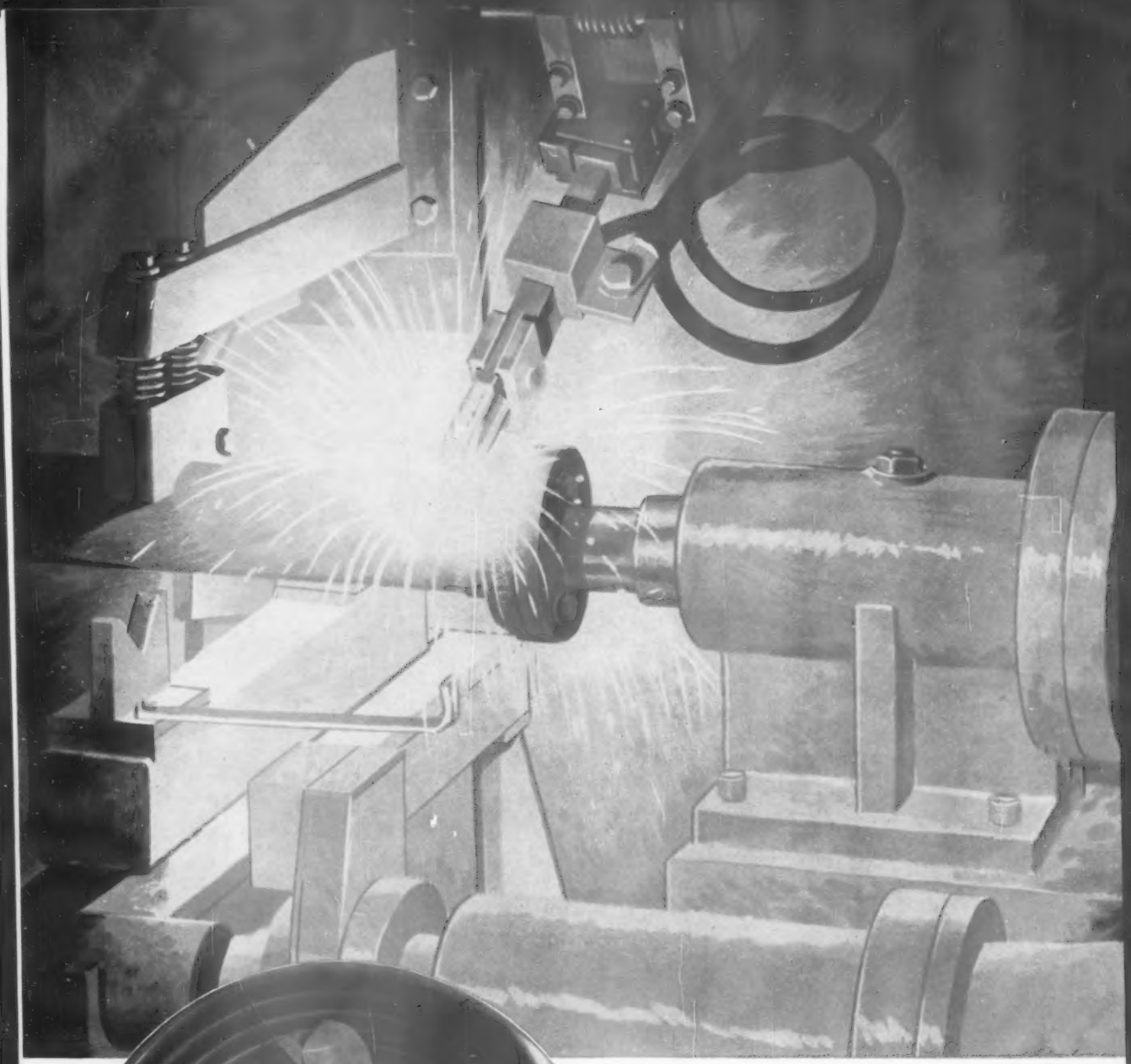

West-Ing-Arc® Dynamic Reactor greatly enlarges the fields of applications for welding and results in many "plus" benefits at a small investment to the user of any semiautomatic or fully automatic welding process equipment employing constant potential (voltage) power source.

If you presently use West-Ing-Arc equipment, or contemplate its use—the addition of the Dynamic Reactor results in cost-cutting extras . . . in addition to the efficiencies already inherent in the West-Ing-Arc process.

Order this versatile addition to your present equipment *now!* Or write for complete details on how this equipment can result in savings. Address: Dynamic Reactor, Welding Division, Westinghouse Electric Corporation, 4454 Genesee Street, Buffalo 5, New York. J-22140

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WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS," CBS TV MONDAYS

A "triple cost-cutting" **EXTRA** for welding mild steels, stainless and aluminum

The **NEW** WEST-ING-ARC®

DYNAMIC REACTOR

FOR USE WITH AUTOMATIC AND SEMIAUTOMATIC GAS SHIELDED, DC WELDING EQUIPMENT UTILIZING CONSTANT POTENTIAL POWER SOURCES

"ALL-POSITION" WELDING!
Overhead—vertical up—and down! Stability of arc at reduced setting.

REDUCED ELECTRODE WIRE COSTS!
Use at least one size larger diameter wire with no change in current setting, voltage or feed speed. Cost reductions from 1¢ to 17¢ per pound of deposited weld metal.

GREATER VERSATILITY!
Light-gauge metals now may be arc welded. No slag removal problems; practically no "spatter" . . . finished products are ready to paint or plate. CO_2 gas shielding for mild steel hand gun welding is practical!

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STYLE 427C503G01

2 LOW-COST, DUAL-RATED MODELS

- Style 427C503G01—150/300 amperes 100% duty cycle—Zone 1 price* **$159**
- Style 565D956G01—300/600 amperes 100% duty cycle—Zone 1 price* **$259**

*Slightly higher in Zones 2 and 3

ORDER NOW!

Watch Westinghouse for New Developments in Welding!

for hard surfacing...

McKAY

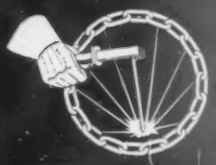
AUTOMATIC & SEMI-AUTOMATIC

tube-alloy® wires

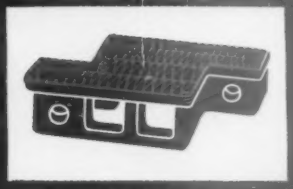
- smooth operation
- high deposition
- uniform, wear-resistant deposits
- controlled chemistry
- wide range of analyses

Years of research, development and experience in welding electrode manufacturing are combined to make McKay "Tube-Alloy" the most efficient and economical wires for automatic and semi-automatic hard surfacing applications. Tube-Alloy wires lay down sound, clean weld deposits of controlled composition and hardness. The closely compacted tubular wires feed smoothly and evenly. Deposition rates are double or more over manual operation . . . thus greatly reducing overall hard surfacing costs.

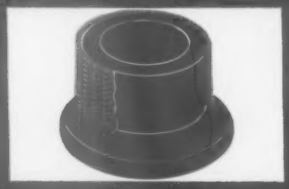
write for
HARD SURFACING CATALOG



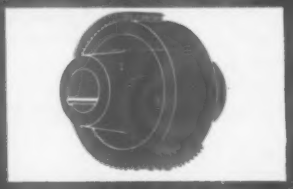
THE McKAY COMPANY • 1005 LIBERTY AVENUE • PITTSBURGH 22, PA.



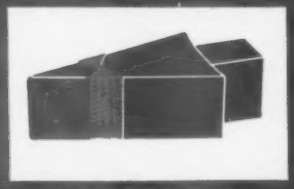
Tractor Rails
TUBE-ALLOY BU WIRE



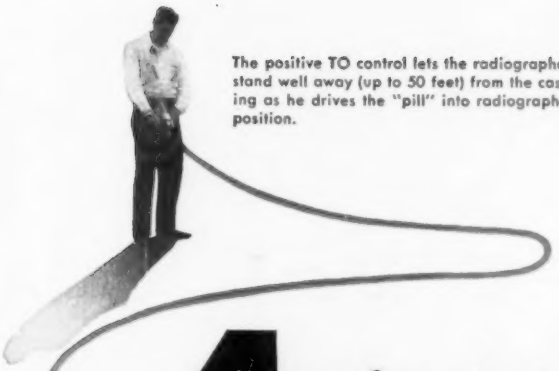
Ditcher Rollers
TUBE-ALLOY 252



Shovel Rollers
TUBE-ALLOY 258



Shovel Bucket Teeth
TUBE-ALLOY 218



The positive TO control lets the radiographer stand well away (up to 50 feet) from the casting as he drives the "pill" into radiographic position.

4 minutes *does it*

The man up there radiographing that 2″ thick steel casting down there will have the job done in four minutes.

That's how fast modern gamma radiography is.

He's doing the job with 50 curies of Iridium 192 carried in this TO412A mobile radiography unit.

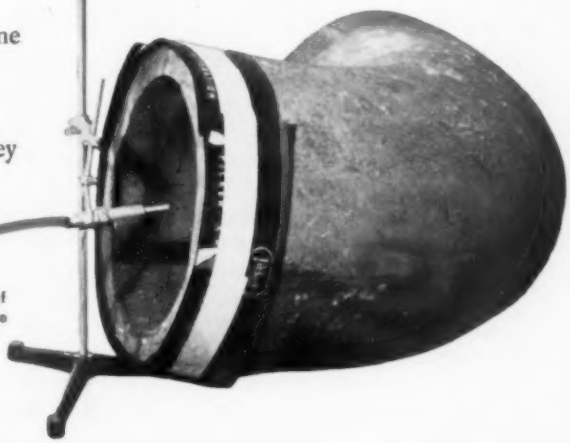
The isotope he's using (Iridium 192) will give him 2% sensitivity, too. Matter of fact, you can easily get 2% sensitivity in sections up to 6″ of steel, brass, copper, bronze . . . even *lead* . . . when you match the isotope to the job.

Makes no difference what you *make* or *buy* or *sell* (plastics, light metals, fabricated parts, assemblies—the list is endless) if it needs radiographic "seeing into" for quality control, we have the machine (gamma or x-ray) to do it most efficiently.

If *you are* confronted by an inspection problem why not let our consulting radiographers see what they can do for you? It will cost you nothing, may save you a lot. Call your local Picker* representative or write us outlining the situation.

Picker x-ray

25 South Broadway, White Plains, N. Y.



One "shot" radiographs the entire girth of the casting. Picker Flexible Film Holders are quickly taped on, quickly removed.

**There's probably a Picker district office near you (see your local 'phone book).*

PICKER . . . one stop for everything in industrial fluoroscopy and radiography

ANDREX lightweight portable x-ray units—130 KV, 160 KV, 200 KV, 260 KV and *Andrescope* X-ray Stress Analyzer.

PICKER x-ray units—5 to 50 KV, 150 KV (stationary and mobile), 270 KV portable, 260 KV heavy-duty, x-ray diffraction apparatus, rayproof inspection cabinets.

ACCESSORIES . . . films, tanks, darkroom sundries, illuminators, *everything*.

TECHNICAL OPERATIONS units for isotope radiography—sources, equipment, containers for Iridium 192 Cesium 137 Cobalt 60 and Thulium 170.

spotlighting

A TREMENDOUS TRIFLE

Previous contact tube design depended entirely on wire cast for limited contact; uncertain current pickup resulted. New-Longitudinal wires, brazed at one end, act as a chuck to insure positive contact.

. . . that dramatically improves the arc stability of your Aircomatic® equipment

Physically, this new contact tube with "floating Chuck" is just a trifle—a simple set of hardfaced "wiping" wires** inserted in the contact tube barrel of your Aircomatic gun. But it gives positive, multiple contact with the welding wire at all times.

It ends interior arcing, prevents burnback, galling, insures good current pickup, increased current capacity and stable arc performance—on Aircomatic welding guns.

The new wiping action contact tube is available in various diameters for the Aircomatic MIGet*, the Aircomatic Pull gun, the Aircomatic push gun (except heavy-duty), and the AMHB Aircomatic head. Also supplied as standard equipment on all new guns. For complete information, contact your Airco office.

Welding wire leaves the barrel through a nest of longitudinal wires. Wiping action assures stable arc performance even with aluminum and magnesium wires.

*Trademark
**Patent Applied For

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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO – Industrial gases, welding and cutting equipment • AIRCO CHEMICAL – vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • PURECO–carbon dioxide–gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • OHIO–medical gases and hospital equipment • NATIONAL CARBIDE–pipeline acetylene and calcium carbide • COLTON–polyvinyl acetate, alcohols, and other synthetic resins.

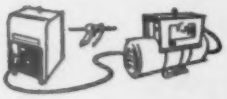
NOVEMBER
1958

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.



. . Magnetic-tape tracer is latest in automated welding. Expert Welding Machine Co. has developed system that permits joining of parts with out-of-tolerance or contour weld edges. Carbon-dioxide Mig welding presently is being used on automotive component, but system is adaptable to submerged-arc and Mig with other gases.

. . .Rome Cable Corp. has developed new system of electric brazing solid and stranded copper wires.

. . High-speed cutting (up to 75 ipm) of J grooves in heavy plate preparatory to welding is said to be possible with new Linde Co. device.

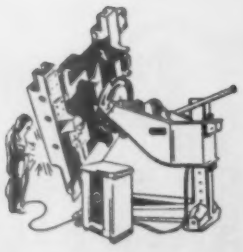
. . Welded sandwiches again are in the news (see April WE, p. 41). This time Lukens Steel Co. has succeeded in rolling high-strength steel sheet to a width of 160 in.—tops, says Lukens, because no other existing rolling facility can match its 206-in. plate mill.

. . Inert (thus safer) synthetic lubricants for oxygen compressors make it possible for oxygen producers to boost gaseous product to process or pipeline pressure. Lubricants are high in cost, but advantages outweigh that factor.

. . Speaking of oxygen, WELDING ENGINEER has found growing trend to on-site liquid installations among fabricators for cutting uses.

. . Steel production continues upswing. But more boosts in prices may be in offing, according to some reports, which claim past summer's hikes were modest.

. . Order for 450 miles (about 94,000 tons) of 24-in.-diameter pipe was received by Republic Steel Corp. from Houston Corp. Pipeline will be used to transmit natural gas from Texas to Florida. It's largest single order ever received by Republic's Gadsden, Ala., pipe mill, whose operations were described by WE last February.



. . Are we on way out of recession? One key trend indicates we are...industrial production has now recovered more than half of its decline.

The clad material in this process vessel is 304 on A 285 Grade C plate. Arcaloy 309 Lime electrodes were used for the entire joint on all girth seams because of variances in the thickness of the plate material.

Approximately 1200 pounds of Arcaloy 309 Lime electrodes were used for seam joints and nozzle fittings on each vessel.

Critical welds demand the quality of

ARCALOY

STAINLESS STEEL ELECTRODES

Stainless steel or stainless clad material is used on critical applications for its corrosion resistance and high strength properties. The nation's leading fabricators specify Arcaloy stainless steel electrodes to retain these properties and to safeguard their reputation.

Colonial Iron Works, Cleveland, Ohio, has relied on Arcaloy electrodes for many years because they produce the quality of weld metal required for critical stainless welds. They know that they can depend on this quality always and in any of the more than thirty different analyses of stainless electrodes made by Alloy Rods Company. They also know that their distributor, Scott-Tarbell, Inc., can meet their needs with "always fresh" electrodes, because they are hermetically packaged in metal to safeguard freshness and quality.

Your Alloy Rods Company representative or distributor has the knowledge and products to meet your stainless steel welding requirements. Give him a call or write direct requesting Bulletin AR-102. Alloy Rods Company, P. O. Box 1828, York, Penna.

QUALITY WELDING ELECTRODES FOR

Stainless Steel
Mild & Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

NO FINER ELECTRODES MADE . . . ANYWHERE

LIFT THIS PAGE TO SEE WHY

A. O. SMITH WELDING MACHINES STAND "HEAD AND SHOULDERS" ABOVE ANY OTHER MACHINES . . .

The following pages provide proof that "Through research, there is a better way"

Through research . . . a better way

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

A. O. Smith INTERNATIONAL S. A., Milwaukee 1, Wisconsin, U.S.A.

Quick guide to **A.O.Smith** welding machines

a-c welding machines

	Series No.	Rated Output Amps.	Volts	KW	KW Input	Open Ckt. Volts	Efficiency %	Power Factor %	Line Amps. @ 230V	Line Amps. @ 460V	Welding Range Min.	Max.	Duty Cycle %
A-C LIMITED INPUT TYPE	A18U	180	25	4.5	6.35	53/80	71	No Cap.	45		25	180	20
	A180U	180	25	4.5	6.0	53/80	70	70	37		25	180	20
	A205	200	30	6.0	8.35	80	72	No Cap.	88.5		30	310	50
		295	25	7.4	8.35	80	72	No Cap.	88.5		30	310	20
HEAVY-DUTY A-C PRODUCTION WELDERS	A200E	200	40	8	10.6	75	75.6	70	66	33	30	350	60
	A300E	300	40	12	14.2	75	84.5	72	85.2	42.6	60	430	60
	A400E	400	40	16	18.6	75	84	72	108	54	75	585	60
	A500E	500	40	20	25.3	75	79	70	144	72	90	670	60
	A650E	650	40	26	30	80	86	72	176	88	200	750	60
EXTRA HEAVY-DUTY PRODUCTION WELDERS	A300	300	40	12	14	75	85.5	88.5	72	36	60	375	60
	A400	400	40	16	18.6	75	86	86	98	49	80	500	60
	A500	500	40	20	23.6	75	85	83.7	128	64	100	625	60
AUTOMATIC A-C PRODUCTION WELDERS	A1000	1000	40	40	44.4	85/100	90	80	244	122	250	1250	1 hr. 100% 3 hr. 75%
	A1500	1500	40	60	66.7	85/100	90	80	366	183	400	1800	1 hr. 100% 3 hr. 75%

d-c welding machines

	Series No.	Rated Output Amps.	Volts	KW	KW Input	Open Ckt. Volts	Efficiency %	Power Factor %	Line Amps. @ 230V	Line Amps. @ 460V	Welding Range Min.	Max.	Duty Cycle %
D-C RECTIFIERS	A2000	200	40	8	12.4	80	64	77.5	40	20	25	345	60
	A3000	300	40	12	19.5	80	64	77	64	32	45	500	60
	A4000	400	40	16	25.0	80	64	75	84	42	55	650	60
	A6000	600	40	24	34.5	80	69.5	70	124	62	120	730	60
AUTOMATIC D-C RECTIFIERS	A8000	800	40	32	45	80	71	76	164	82	200	1050	100
	A10000	1000	40	40	57.2	80	70	72	200	100	200	1240	100
	A12500	1250	40	50	69.4	80	72	70.6	247	123	265	1500	100
	A25000	2500	Information available on request.										
CONSTANT POTENTIAL	A6000 CP	600	40	24	32	0/50	75	99	82	41	0 Amps @ 0 Volts	600 Amps @ 45 Volts	100
MULTIPLE OPERATOR POWER SOURCES	A5000 MO	500	74.5	37.25	40.4	80	92.5	93		55	0	500	100
	A7500 MO	750	75	56.2	59.2	80	95	96		73.5	0	750	100
	A15000 MO	1500	73.5	110	117.2	80	95	97		152	0	1500	100
AC/DC INERT ARC WELDERS	A2000 AD	AC 200	40	8	10.1	AC 75	AC 79	AC 76	58	29	AC 7	AC 300	60
		DC 200	25	5	10.4	DC 68	DC 48	DC 76	58	29	DC 5	DC 200	60
	A3000 AD	AC 300	40	12	15.4	AC 75	AC 78	AC 76	90	45	AC 10	AC 440	60
		DC 300	25	7.5	15.0	DC 68	DC 50	DC 76	90	45	DC 7	DC 300	60
	A5000 AD	AC 500	40	20	25.3	AC 75	AC 79	AC 75	148	74	AC 12	AC 670	60
		DC 500	25	12.5	25.5	DC 68	DC 49	DC 75	148	74	DC 10	DC 500	60
D-C CONVERTORS	A2500 C	Model A2500 C is DUAL RATED							250 Amps @ 40 Volts, 60% Duty Cycle 300 Amps @ 40 Volts, 40% Duty Cycle				
	A4500 C	Model A4500 C is DUAL RATED							450 Amps @ 40 Volts, 60% Duty Cycle 500 Amps @ 40 Volts, 45% Duty Cycle				
D-C GAS DRIVES (Air and Liquid Cooled)	A2000 A	200	30	6		67					45 Amps. @ 30 Volts	200 Amps. @ 30 Volts	50
	A2000 WG	200	40	8		80					40 Amps. @ 20 Volts	250 Amps. @ 40 Volts	60
	A3000 WG-S	300	40	12		80					60 Amps. @ 20 Volts	375 Amps. @ 40 Volts	60
	A4000 WG-S	400	40	16		80					80 Amps. @ 20 Volts	500 Amps. @ 40 Volts	60

GUARANTEE — All A. O. Smith Welding Machines are guaranteed to provide for free replacement of any part that fails, due to defective workmanship or material, within one year from date of purchase.

BEFORE YOU BUY ANY WELDING MACHINE, investigate this line in detail. You'll see why you buy better when you buy A. O. Smith job-matched power.

PRODUCED BY WELDERS — FOR WELDERS: Because welding is our full-time business, we can offer you America's finest welder-proved electrodes, machines and accessories.

Through research . . . a better way

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A. O. Smith INTERNATIONAL S. A., Milwaukee 1, Wisconsin, U.S.A.

MW-231 9-58 LITHO U. S. A.

These are some of the "tangible" reasons why

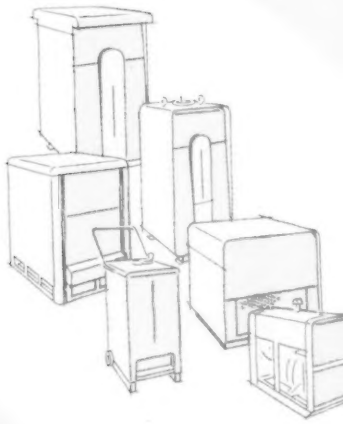
A. O. SMITH WELDERS OUT-PRODUCE, OUT-LAST THEM ALL

No other line of welders can offer all these stand-out advantages...

While other welding machine manufacturers have been cutting corners on materials, on fabricating care, on special features — A. O. Smith has been operating in the opposite direction. New and better (though more expensive) materials have been used. And instead of short-cutting precision manufacture — A. O. Smith has improved their own manufacturing techniques to the point where you get premium quality at mass-production costs.

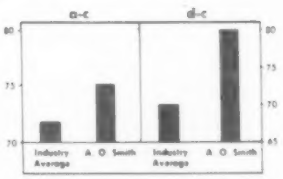
Further, each A. O. Smith machine has been fully "floor tested" in actual production. A. O. Smith is one of the world's largest users of welding in its own production!

Check over just a few of the reasons why A. O. Smith welders give you bonus hours of un-interrupted production at lower cost —with improved welding characteristics.

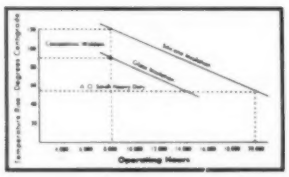


A. O. Smith offe
limited input, genera
dc rectifiers, air a
gasoline driven mod
Also, there are
convertors

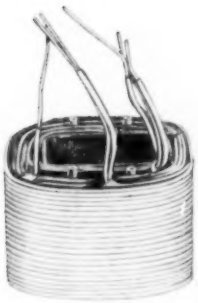
Totally enclosed, pre-lubricat
ball bearing, 1/6-hp fan moto
big fan — Only A. O. Smith
machines are built with a bi
forget-about-it motor that ne
reservoir filling or other cost
stopping maintenance. Bigge
the industry, sustains tremend
of high-velocity air to keep
running cool.



Generally speaking, A. O. Smith machines offer more open circuit volts than any other line. And more open circuit volts mean more arc stability, faster arc action, smoother operation at any setting. You get better welds, fewer rejects.



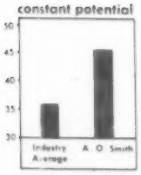
All A. O. Smith machines have it! Silicone (Class H insulation) is the newest, most expensive insulation known to the electrical industry. Despite higher costs, A. O. Smith is the *only* machine manufacturer using silicone "right-across-the-board" on *all* models. Silicone permits higher operating temperatures under peak load conditions and absolutely prevents coil damage due to moisture accumulation. Longer life is assured.



On A. O. Smith units, coils are not only vacuum-impregnated, they're also precision wound. Result: They're resistant to moisture and there's no possibility of chafing each time an arc is struck. This double protection results in stepped-up efficiency — for years on end.

mith offers 39 basic machines — t, general-duty ac, heavy-duty ac, rs, air and liquid cooled iven models, constant potentials. ere are plug-in "shoe-box size" nverters that convert ac machines to dc in seconds.

-lubricated, fan motor and O. Smith welding with a big husky, that needs no ther costly production- e. Biggest fan in tremendous volume to keep machine



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SILICONE INSULATION

DOUBLY PROTECTED COILS

TAILORED TO YOUR NEEDS

MORE MOTOR —MORE FAN

OPERATIONAL FLEXIBILITY

See the model ratings on the back page and check with your "man from A. O. Smith" for comprehensive details . . .

Through research . . . a better way

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CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

A. O. Smith INTERNATIONAL S. A., Milwaukee 1, Wisconsin, U.S.A.

A.O.Smith
WELDING

D.C. WELDER

BETWEEN PASSES

costly tribute

Toronto citizens in the neighborhood of 123 Eglington Ave. East, heard thunder of a different sort during a severe storm on September 6. Approximately 1,800 tons of structural steel—the framework for what would have been Union Carbide Canada Ltd.'s new 11-story headquarters building—came crashing to the ground. This was to have been an all-welded structure, but at the time of the collapse, upper portions of the building had not yet been welded and were held together with erection bolts.

Why did the collapse occur? Will it give welding a black eye? These are important questions, and they're best answered by a man on the scene: R. M. Gooderham, director of the Canadian Welding Bureau. In the following letter to WELDING ENGINEER, Mr. Gooderham presents his extremely interesting views.

"This disaster has been a great tribute to welding and to all those . . . concerned with it. At present, it is not known why the building collapsed, but we have heard one suggestion that it was due to defective welding. Actually, it is almost unbelievable how the welds stood up, and this is particularly the reaction of those who perhaps are not . . . familiar with welds.

"The structure went down during a lightning storm with high winds gusting to 50 or 60 miles per hour. We understand there is evidence that one of the guy wires was struck. Upper parts of the building had not been completed, and girders and upper column sections were temporarily bolted into position. Possibly these broke away, crashing down through the rest of the building and collapsing it almost like a pack of cards.

"The hold-down bolts of the columns pulled out, and each fell in a direct line upon the others. Some of those columns contained material nearly 4 in. thick, so the forces involved were obviously tremendous. Great 36-in. girders were twisted in all directions—particularly some of those which fell over the reinforced concrete vault.

"With all this destruction, there appears to have been only *one* weld which parted in the crash. This weld was in one of the columns badly bent over the vault. In this respect, however, it should be understood that welds in columns are only partially completed. In other words, they do not have a full cross-section since they are not expected to stand any appreciable stress other than compression.

"So impressive are the results that we have made arrangements to conduct tours of engineers and architects over the site. We also plan to publish illustrated literature for general circulation to show the non-destructibility of properly welded connections. [Though it was a most unfortunate occurrence] we doubt if ever before there has been such a major test of a welded structure—and such proof of weld quality."

"Exploring . . . stars"

Readers of WELDING ENGINEER will remember the thorough reporting job in articles written by Clyde B. Clason when he was managing editor of this magazine. Clyde, who has more than just a few books to his credit, has now authored an extremely interesting work on astronomy. Entitled "Exploring the distant stars," the book is written for the layman who cannot always understand the more complicated texts aimed at professional astronomers.

Published by G. B. Putnam's Sons, New York City (in Canada by Longmans, Green and Co., Toronto), the cloth-bound book has 384 pages and is priced at $5.

"Exploring the distant stars" is really four books in one. The first section deals with "Mapping the heavens," with sections two and three discussing "The attack on the stars" and "Stars in action," while the fourth has us "Exploring the galaxies."

Since the advent of earth satellites, there has been a greater awareness of, and interest in, outer space, which gives a timeliness to this book it might otherwise not have enjoyed. Ranging over the whole of astronomy, Clason takes us from the star gazers of Babylon to the most recent developments in astronomical science.

The volume opens with simple facts about constellations and the manner in which stars were named, gradually working the reader into more difficult phases of astronomy in pleasant doses.

Clason weaves a graphic tale of the universe.

slogan du jour

WE hoped for welding industry support in its recent campaign to help the public "Remember September—National Welded Products Month." Support it got . . . sometimes in unexpected ways. Consider, for example, the action taken by Fibre-Metal Products Co., Chester, Pa.

Most of the F-M boys, reports Sales Manager Charlie Bowers, Jr., tie on their noontime bibs in Shooster's Restaurant at Ninth & Flower St. in Chester. So what did they see on the menu each day—sandwiched between the charcoal-broiled club sirloin steak and the pan-fried baby steer liver with onions? The "slogan of the day," naturally: *Remember September—National Welded Products Month!*

Hope the F-M crew will get the same fine cooperation from Shooster's for the new *WE*/AWS-sponsored campaign to "Remember April"—the month in which National Welded Products Week will be observed in conjunction with the annual welding show.

forecast—biggest yet

Reports of advance space reservations for the 1959 AWS show in Chicago indicate this one will be the biggest yet! Thousands of visitors — including many from overseas—are expected to attend the technical meeting April 6-10 at the Hotel Sherman and the Welding Show itself at the International Amphitheatre April 7-9.

4 in 1

3 in 1

2 in 1

WELDERS/ POWER PLANTS

Hercules (Lycoming design) air cooled engine

FIREBALL AMPERAGE RANGES

Tungsten Inert Gas		Metallic Arc	
DC	AC	DC	AC
35 - 100	35 - 75	35 - 80	35 - 100
85 - 225	65 - 160	75 - 175	65 - 160
170 - 375	150 - 375	125 - 350	110 - 400

DAH-350 FIREBALL four-in-one model is the only complete unit made to incorporate an ac-dc welder for (1) metallic arc, or (2) tungsten inert gas welding, plus (3) ac power plant, and (4) 1 KW dc power while welding. Twelve separate amperage ranges as shown above. Additional standard equipment features include a polarity switch, either continuous or "start only" high frequency and an automatic inert gas control panel with solenoid valve and postflow timer. Rated output at 100% duty cycle: 250 amps dc tungsten arc; 300 amps ac tungsten arc. Generator: 10 KW of 115/230v, single phase, 60 cycle ac.

DA-300 BIG RIG. Combination ac-dc welder, plus an ac power plant, plus 1 KW of dc power while welding, give this model three-in-one versatility. Generator rated at 10 KW of 115/230v, single phase, 60 cycle ac. Welding ranges in amperes are: (dc) 75-175 or 125-350; (ac) 65-160 or 110-400. Rated output at 100% duty cycle: 250 amps dc at 40 volts and 300 amps ac at 40 volts.

D-250 ROUSTABOUT provides a two-in-one arrangement whereby either of two dc welding current ranges — 75-175 amps or 125-350 amps — and 1 KW of 115v dc auxiliary power are available simultaneously. Rated output is 250 amps at 40 volts, 100% duty cycle. Generator produces 10 KW of 115/230v, single phase, 60 cycle ac.

All models offered with skids or trailers. Complete specifications and prices sent promptly.

miller WELDERS

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EXPORT OFFICE: 250 East 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

How Ni-Rod "55" builds up worn cast iron... keeps repair cost down

When the owners of the M V Sunprincess heard it would cost them over $7,200 to replace all six worn ship pistons, they quickly called in J & R Weir Ltd., Marine Engineers, Montreal.

These engineers in turn recommended a Ni-Rod "55"* repair job — welding to be done by Welding Engineers Ltd., Montreal.

Wear ran as high as ⅛ inch on some of the piston ring grooves. But with Ni-Rod "55" Electrodes, welders soon had all six pistons back in the ship at a total cost of $2,450 — a saving of over $4,750.

How they did the job with Ni-Rod "55"

Using Ni-Rod "55" Electrodes, they welded cast iron inserts into position on the pistons to offset the worn areas. The pistons were pre-heated to 500 F and each of the 6 inserts welded into position with two passes by manual arc-welding. After welding, the pistons were covered with asbestos to cool. Ni-Rod "55" eliminated the need for post-heating. Then the pistons were machined and returned to the engine.

For your jobs

Ni-Rod "55" can be used to build up worn areas in almost all cast iron parts. Auto, truck, or ship pistons... valve seats... cylinder walls... are just a few. And the cost is just a fraction of what replacement would cost. What's more, with Ni-Rod "55", the repair is done quickly and easily. Welds are strong, sound, highly machinable.

Keep Ni-Rod "55" in mind for building up worn areas on cast iron parts. Even better, have a supply of these electrodes on hand. Look in your classified directory under "Nickel" for your local supplier.

And *write* for "Repair Cast Iron Parts Quickly and Easily" for the complete Ni-Rod "55" story.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N. Y.

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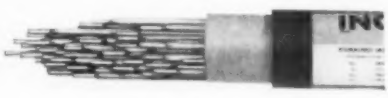
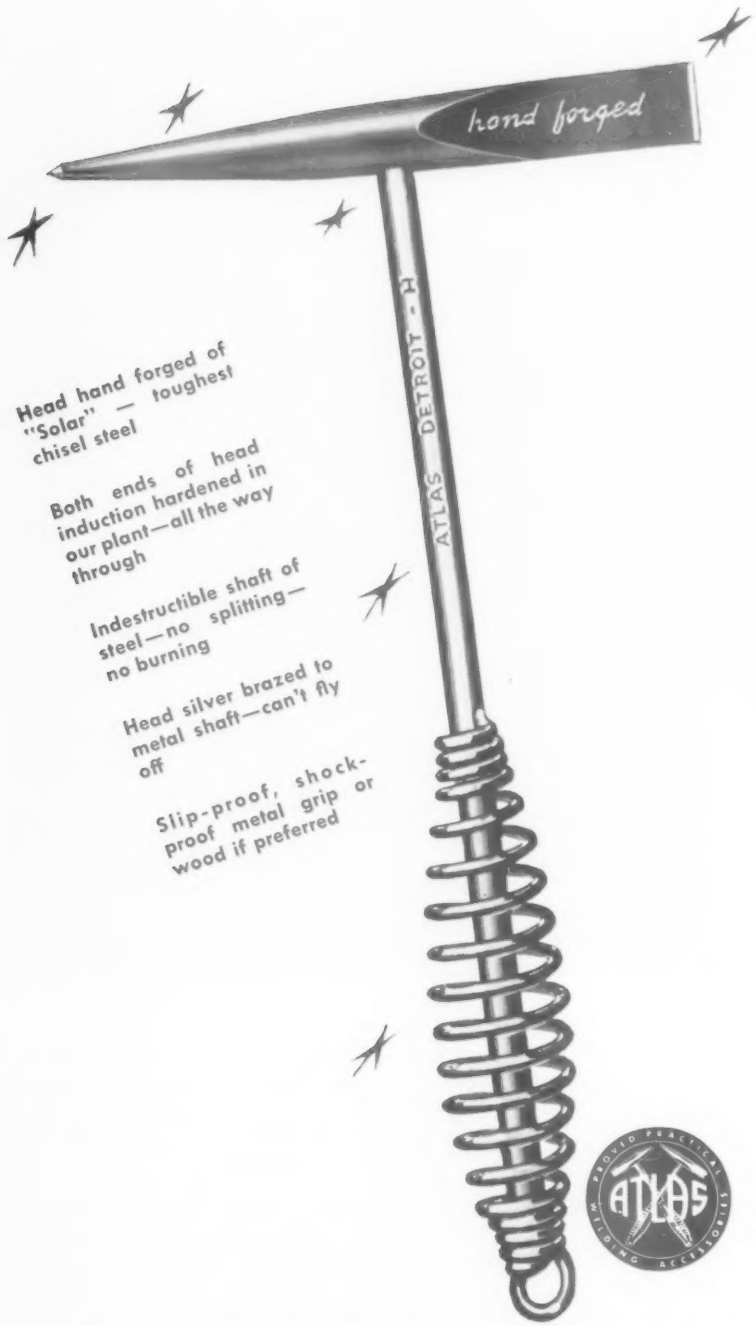
INCO WELDING PRODUCTS

electrodes • wires • fluxes

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Letters . . .

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

WE in Classroom

San Jose, Calif.

Sir:

I am one of the part-time welding instructors at the San Jose City College.

I wish to thank you for your timely article, "The fundamentals of welding engineering," (August, 1958, p. 49) . . . I would like to secure permission to copy and mimeograph this material for my students. I will credit the origin of the material to the editors of *Welding Engineer*.

The college receives *Welding Engineer* for classroom reading by the students. Your articles and editorials provoke much useful classroom discussion.

My course is designed primarily for those weldors who wish to acquire the skill of Tig welding.

As an instructor I am always pleasantly surprised at how much I learn from the students, many of whom have been welding for 10 years or more.

I introduce the students to the subject matter that is contained in the *Welding Engineer*. After they leave my class a good many of them have continued to study technical problems concerned with welding.

I will use the material in the article mentioned to encourage further study in this field.

Thanks and may we have more such articles.

Jesse Edwin Goss

Precious issue

Bangkok, Thailand

Sir:

. . . We would like to make some comments about your 1958 Fact File issue. We consider this document invaluable to our firm because in a few pages we can find sources of information on any type of welding equipment or supplies we are interested in.

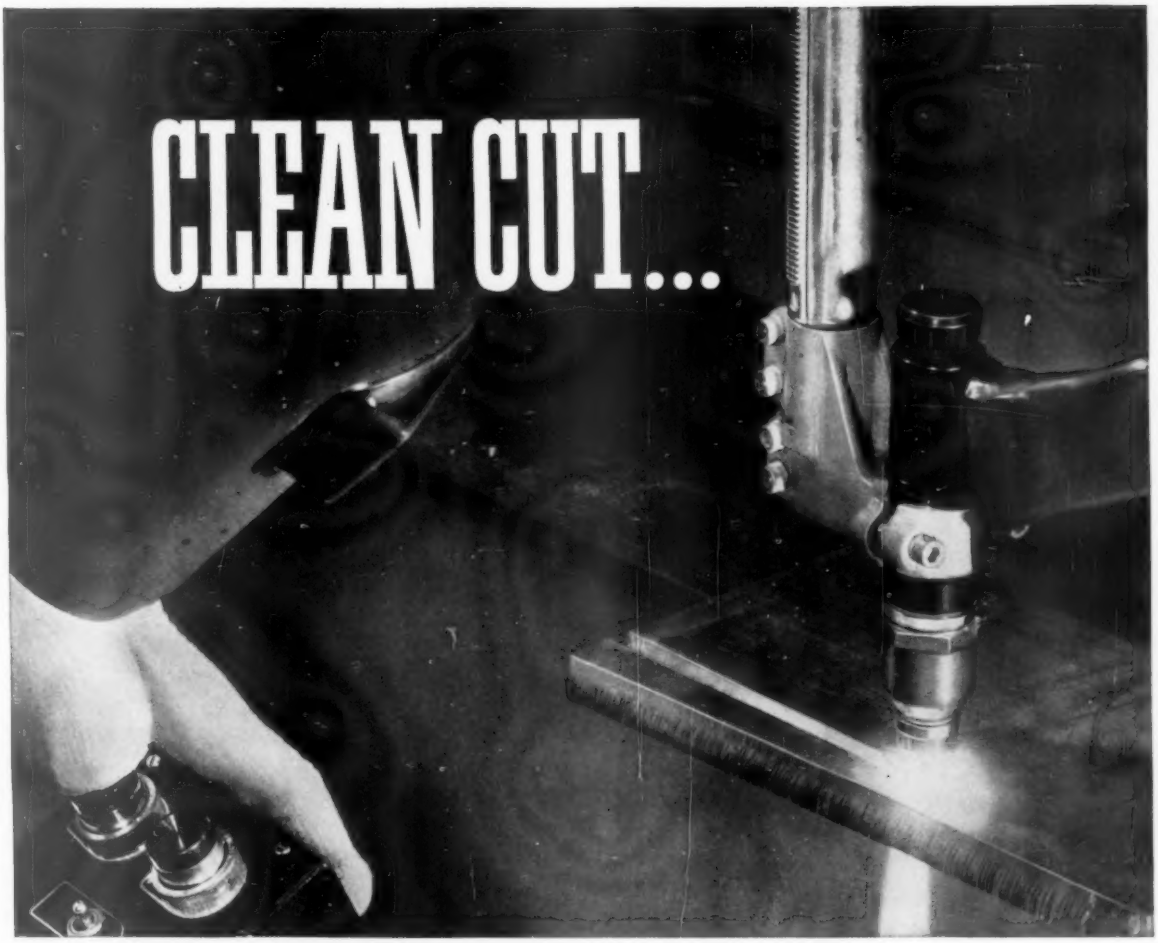
We hope to receive the 1959 issue, which . . . we will consider the most precious document in our welding library.

EFTI Engineering Consultants, Ltd.

Sir: *Chicago*

Re. "The meaning of weldability" (Mid-June Fact File, 1958) . . . congratulations on publishing a fine, long sought summary on a much misunderstood subject.

T. F. Luga
Welding Engineer



. . . HELIARC Cutting turns hours to minutes

Before: It took 1½ hours to chip an 18-inch hole in an aluminum dome ⅝-inch thick. NOW—The hole is cut in *one minute*—with HELIARC Cutting.

Before: A 54-inch diameter dome hole in ⅝-inch rolled aluminum plate required about 5 hours, with chipping hammers. NOW—Manual HELIARC Cutting does it in about 4½ *minutes.*

HELIARC Cutting employs an extremely high-temperature, high-velocity arc that gives cutting speeds up to 1000 inches per minute on ¼-inch-thick material. It makes saw-like cuts, either square or beveled, in materials up to 3 inches thick . . . *and,* you can take the torch to the work. HELIARC Cutting is equally effective on aluminum, stainless steel, magnesium, copper, carbon steel, or cast iron.

See for yourself—ask your nearest LINDE representative to *prove* that HELIARC Cutting slashes time and labor costs over conventional methods. Call your local LINDE office today! Or write **Box WE-11,** LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

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HOW YOUR NEXT JOB WILL BE HANDLED FOR LESS COST

For lowest cost, Weldynamics indicates that both AC & DC welding currents are needed to take full advantage of today's high-speed electrodes. One machine, Idealarc, fills this need . . . does the work of two welders. As a result, you need fewer machines, work scheduling is simplified, there are fewer machines standing idle.

Lincoln men, trained in Weldynamics, will show you how to apply these cost cutting advantages to your specific jobs—with the latest methods and electrodes available today.

Idealarc 180, 250, 300, 400 and 500 amp sizes. Available as AC or AC/DC welder. Can be purchased with AC only, adding DC later. Operates on single phase power. Write for Bulletins SB-1364 and SB-1343.

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THE LINCOLN ELECTRIC COMPANY, DEPT. 1747, CLEVELAND 17, OHIO

NOVEMBER, 1958

Welding Engineer

ESTABLISHED 1916

Your stake in welding

EDUCATION CONTINUES TO BE the largest need in the welding field. *WE* has discussed this subject for years, and while some headway has been made, particularly through the Foundation for Education in Welding, much still remains to be done.

Anyone in welding who has a "friend at court" in an engineering school can benefit himself by taking a little time out to sell welding.

A good start would be to find out what the Dean of Engineering knows about welding. If his knowledge is slight, then perhaps *FEW*'s pamphlet, *Modern Welding Practices*, would enlighten him. The National Welded Products Month reprint from WELDING ENGINEER's September issue, also being distributed by *FEW*, will show him how important welding is to everyday living.

If he does not have these two "facts of life" on welding, see that he and the professors of mechanical and structural engineering get them.

Such action may sell institutions on the idea of instructing more students in welding. *At least it will point up welding as more than just a shop course.*

We now have the school interested in dispensing welding information, but what to use for information? This is where industry can help.

In the past, we have suggested that manufacturers of welding equipment and supplies might want to contribute to educational programs. Unfortunately, this hint has generally fallen on deaf ears.

However, *users* of welding might wish to participate in such a program. In the long run, they would benefit most, since they would obtain the services of competently trained welding engineers. Scholarships, granted to *FEW* or to specific schools, or simply the act of contributing information and photos of up-to-the-minute jobs and developments would be helpful.

The information and photographs could even be developed into lecture series for professors teaching welding design, fabrication or fundamentals of welding engineering.

This is one of our biggest jobs. It can be done piecemeal by *FEW*, or through the cooperative efforts of many *WE* readers. Your stake in welding is like your stake in anything else. The returns are directly proportionate to the efforts expended.

What returns do you want from welding?

Carl Brainard, Sacramento, California, cutting steel plate with 44-year-old Victor torch butt and 38-year-old cutting attachment.

This old-time torch tells why . . . . .

The man on the job likes Victor Equipment

IT'S LONG-LIVED—Back in 1914, Brainard Bros., Sacramento, Calif., bought one of the first Victor welding torches, direct from L. W. Stettner, pioneer welding torch and safety regulator inventor, now president of Victor Equipment Company. Six years later Brainard Bros. added a cutting attachment.

IT'S FLEXIBLE—This outfit (shown here) has been in constant use ever since on the wide range of welding and cutting operations required in fabricating and repairing mining, logging and sawmill equipment.

IT'S RELIABLE—Victor's current model cutting tips and welding nozzles fit it perfectly—proof of Victor's lasting reliability.

You, too, can get this kind of service from Victor welding and cutting equipment. Ask your dealer to demonstrate why it pays to standardize on Victor.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines. 51

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A MESSAGE TO MANAGEMENT

The following is an open letter to management which WELDING ENGINEER *recently received from a weldor with 30 years experience.* WE *feels there is a lesson to be learned by all from this man's experience in his most recent job. His name is withheld for obvious reasons.*—Ed.

ARE YOUR WELDORS free to meet and discuss their technical problems with a qualified welding engineer? If a "chain of command" method is practiced, are your welding engineers and supervisors qualified in the latest welding techniques?

If you are in management in the welding industry and cannot answer an honest *Yes* to these questions, you do not deserve your position.

Why are code-qualified weldors placed under sheet-metal and machine-shop foremen? This is definitely *not* qualified supervision. I have worked in welding for 30 years, and still consider the art of laying a bead a most fascinating phenomenon.

I have worked with many processes on various metals as a welder, inspector, supervisor and manager. I may be working for you now, and the shop described below may be your shop.

Recently I started on a new job for a large, internationally known company whose small division is a new addition to my area. We fabricate large welded structures, pressure vessels and numerous other welded parts. Materials are classed as nonferrous and exotic.

Above-average wages and a new, well-ventilated shop helped me decide this would be a good place to work. I had met two of this company's welding engineers, and both talked the weldor's language. The fact that I would be working under them, with skilled weldors as supervisors, was the final convincing factor.

I had visions of the newest and best equipment and a good clean weld shop. What a pipe dream! I ran into the greatest disappointment of my life.

While being interviewed by the foreman, several weldors with whom I had worked on previous jobs stopped to greet me. This recognition seemed to satisfy the foreman as to my experience, and he did not mention a shop test. Disappointment number one.

Some days later, when I had filled out all the necessary forms and had started my first day on the job, I received my second disappointment. The foreman assigned me locker space, a tool cupboard and a welding machine. Any good weldor appreciates a decent welding machine—but I have seen better equipment in many "joe magee" shops.

The foreman was called away before he could assign me a specific job, so I cleaned the work area and straightened the lead cables. In a nearby cupboard I noticed some nearly-new leads, new electrode holders and a short, lightweight whip. I connected them and got the unit in working order.

Still having no job assignment, I offered to help the other weldors with their jobs. I noted that their equipment was in poor condition.

During lunch, each weldor openly stated he regretted leaving his last job. By this time I was feeling disappointments keenly, but pride would not let me openly admit it.

When we returned to the job, I was still a helper, so I asked one of the older weldors to introduce me to the welding supervisors. Toned down for publication, his reply informed me that "the supervision here doesn't know a-c from d-c."

Remember that the cost of some weldments on which we were working totaled many thousands of dollars. This was code work, and almost every known testing method would be used to check the welds. Tolerances allowed in the finished dimensions were only a few thousandths of an inch.

It soon became apparent that if there were any doubts (and we had plenty) concerning technical welding problems, I could: *(1)* look up the information in my own handbooks or, *(2)* telephone one or both of my engineer friends.

The first time I requested the foreman to contact the welding engineer, I was in the doghouse for weeks. That was when I learned the foreman had only a machine-shop background and no knowledge of modern welding processes and procedures.

After many months and many requests, the foreman did call in the welding engineer a few times. But on several occasions he attempted to secure the information by phone and relay it, and at times this information was wrong simply because he was ignorant of welding terminology.

In this particular plant, the maintenance people will not perform repair work on any machine until they have a written request from the shop foreman. And since the weld shop is under machine-shop supervision, it is only natural for the foreman, a machinist, to ignore the weldor's needs.

We do not know the yardstick used when selecting supervision. We can only see the extra man-hours put into rework, and the number of units that must be written-off and scrapped. We follow procedures we know are not as efficient as they could be.

If you are head of the manufacturing department, you may be the one I'm writing about. I may be working for you. And if you are in management, I know you have placed men as supervisors of your weld shops who could not hold jobs as weldors' helpers in a "joe magee" shop.

Remember, a well-supervised weld shop is a source of profit to management, and it is a pleasure for weldors to work in such a shop. But a poorly equipped and supervised weld shop is just a breeding ground for financial losses, for the loss of employee morale, and for ulcers.

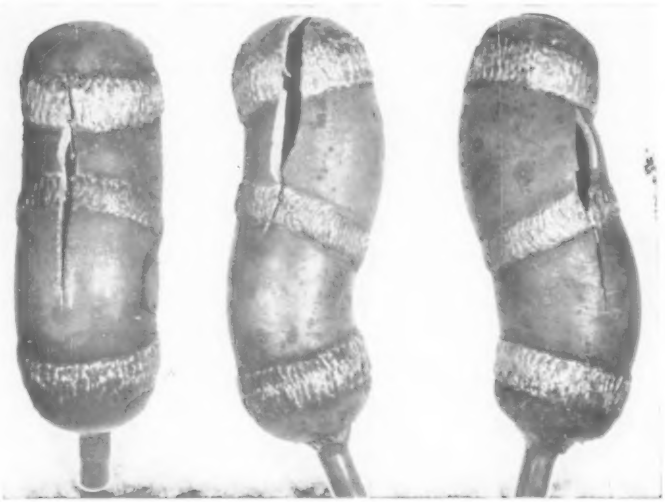
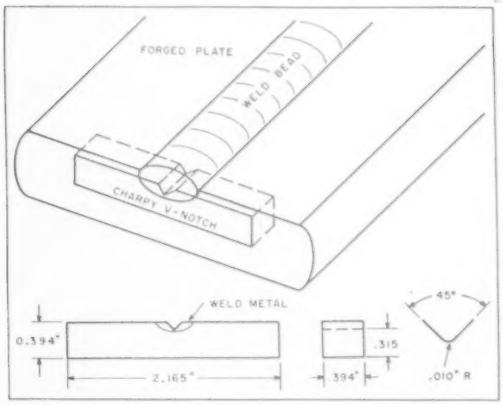


FIG. 1 *(right)*: vessels fabricated from commercial 45-deg long-radius welding fittings following hydrostatic bursting test. Elbows in vessel at left were forged for Canadian Clyde from British steel. Other vessels contain fittings forged by two U. S. companies from American steel.

FIG. 2 *(below)*: location and dimensions of Charpy V-notch specimens taken for impact studies.



Recent investigation determines:

The effect of arsenic on mechanical properties of welds in mild steel

by **D. Canonico** and **H. Schwartzbart***

ARSENIC'S EFFECTS on the mechanical properties of welds in mild steel was the subject of an investigation just completed by the Metals Research Dept. of Armour Research Foundation.

Specifically, the study was directed toward a determination of arsenic's role in the behavior of welding fittings. Sponsoring the research was a Canadian manufacturer which markets the fittings forged from British-made steel corresponding to ASTM A106 Grade B.

Several of this firm's fittings were employed in the investigation, as were fittings manufactured by two U. S. firms from American-made A106 Grade B steel. The reason for the introduction of American-made fittings was the fact that steel produced by the British process can have an arsenic content at least 10 or 20 times greater than that of U. S. steel.

Prior investigations on the effects of arsenic[1-3] failed to provide needed information on the performance of welding fittings. A great deal of work has been done on the effects of phosphorus, sulphur and other elements on impact properties of steel. But arsenic's effects have been relatively neglected—especially in welds on the steel in question.

The study undertaken by ARF's Metals Research Dept. consisted of three phases:

1. The bursting strength of vessels fabricated from commercial welding fittings.

2. The bursting strength of vessels fabricated from laboratory steels.

3. The impact properties of laboratory steels containing various arsenic and phosphorus levels.

As the investigation commenced, commercial welding fittings (45-deg long-radius elbows) manufactured by the sponsor and by the two American companies were welded into the small vessels illustrated in Fig. 1. All

*The authors are associated with the Metals Research Dept. at the Armour Research Foundation, Illinois Institute of Technology, Chicago.

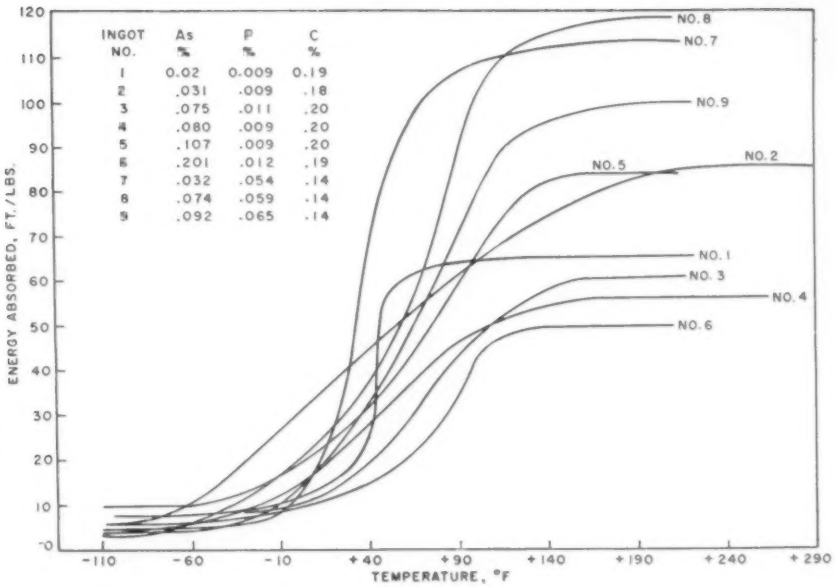


FIG. 3: Charpy V-notch impact curves show test results as energy absorbed vs. testing temperature.

fittings were nominally identical in dimensions, having outside and inside diameters of 2.875 and 2.469 in., respectively.

Welding was done with E6010 electrodes, and multiple passes were used to conform with the customary production technique. All of the vessels were welded in an identical manner. The girth welds joining the pairs of 45-deg elbows were radiographed 100% before caps were welded on. These welds were sound in all cases, and no differences were observed among the three lots of fittings.

Three vessels were fabricated from the fittings of each manufacturer, and all were hydrostatically tested to destruction at room temperature. The fittings from each manufacturer also were analyzed for chemical composition.

Results of bursting tests and the chemical analyses are given in Table I. (The burst vessels are shown in Fig. 1.) The table indicates that the Canadian fittings, made from British steel, contained 20 or 30 times more arsenic than the American fittings. But there was no significant difference in the strength of the vessels made from these various fittings.

The difference in strength that was observed can be attributed to an actual difference in wall thickness, although all fittings had the same nominal dimensions. Failure of all vessels occurred in ductile fashion, and was preceded by considerable plastic flow.

For the second phase of the investigation, three split heats of steel with a base composition conforming to ASTM A106 Grade B were induction melted and cast into ingots. These 110-lb. 5¾-in.-diameter ingots contained various arsenic amounts at two general phosphorus levels.

Sand molds were utilized, but porosity-free ingots were cast only after initial experiments showed that it was necessary to thoroughly kill the heat with approximately 2 lb of aluminum per ton of steel in the furnace before adding arsenic in the ladle. Arsenic was added in the form of a master alloy containing 10% arsenic. Re-

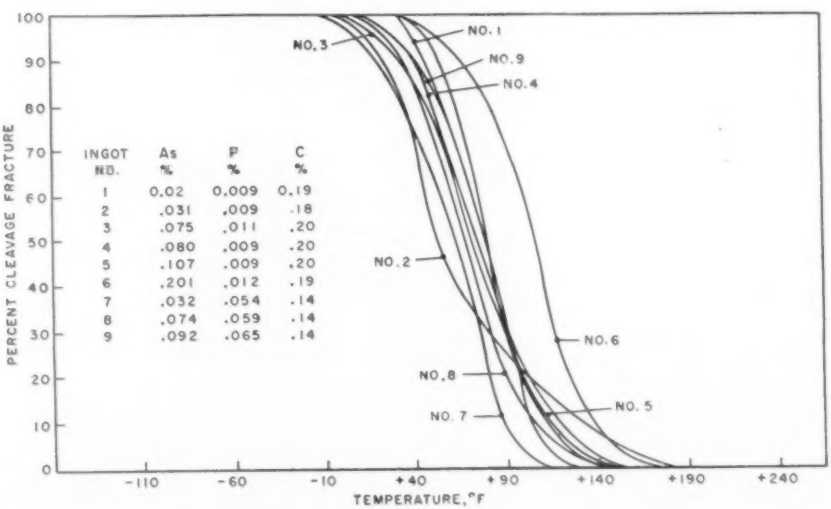


FIG. 4: impact data based on percent of cleavage fracture. This percentage was obtained by visual estimation on fracture surface.

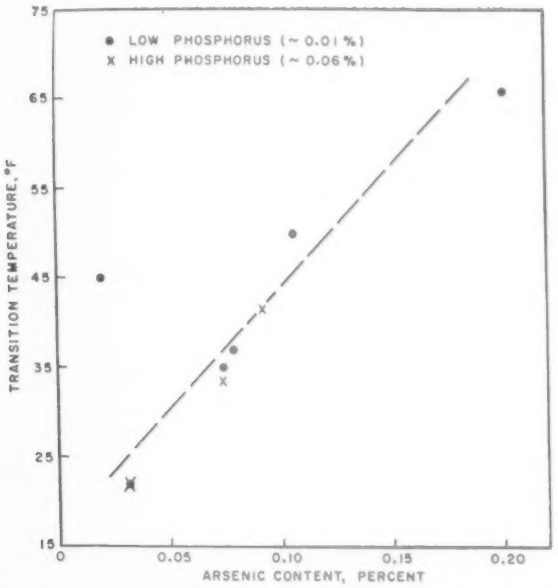


FIG. 5: effect of arsenic content on transition temperature, based on 90% cleavage fracture criterion.

mainder of the alloy was Armco iron.

Table II presents chemical compositions of the laboratory heats. It can be seen that none of the ingots contain as little arsenic as commercial American fittings.

Ingot No. 1 was to contain no arsenic, so none was added to the casting. When a surprisingly high arsenic content was noted in the ingot, therefore, the Armco iron used as melting stock was immediately analyzed. It was found to contain 0.03% arsenic.

Armco Steel Corp. later confirmed the fact that Armco iron can, indeed, contain this much arsenic. So the desire to include an ingot with practically no arsenic was obviously defeated.

After casting, the ingots were ground to remove surface defects and forged to the desired sizes cited below.

Parts of ingots 1 through 6 were hot forged to 3¼-in.-diameter bars. From these bars, 3-in.-long pipes were machined with an outside and inside diameter of 2.875 and 2.469 in., respectively.

Small pressure vessels were then made from these pipes in a manner identical to that used on the commercial welding fittings. Commercial end caps were also used in conjunction with laboratory steel pipes to make these vessels, which were then hydrostatically tested to destruction at room temperature.

Results of the test are presented in Table III, and it can be seen that arsenic had no adverse effect on bursting strength. Ingots 2 and 4, which came from heat B (Table II), contained some entrapped sand seams which lowered bursting strength.

Failure occurred in ductile fashion—by a longitudinal split—just as it did in those vessels fabricated from commercial fittings. (One exception to this was a vessel made from ingot No. 3, which contained an unsound weld and failed in the weld seam.)

To provide material for impact studies—the third phase of the investigation—ingot material was hot forged into plates 5 in. wide and ⅝ in. thick. With an E6010 electrode, a single weld bead was laid longitudinally along the center of the plate.

Charpy V-notch specimens were then cut from the plate in a manner shown in Fig. 2. The base of the V-notch was located at the interface between weld metal and the heat-affected zone, a point determined by etching.

Results of the impact tests are presented in Fig. 3 as energy absorbed vs. testing temperature, and in Fig. 4 as percent of cleavage fracture vs. testing temperature. (The percentage of cleavage fracture was obtained by visually estimating the portion of the fracture surface exhibiting the typical shiny, crystalline appearance of brittle fracture.)

To evaluate arsenic's effect on the transition temperature at high and low phosphorus levels, it is necessary to select a measure of the transition temperature. Criteria of transition temperature utilized in previous investigations have included the temperature at some arbitrary level of energy, or at some arbitrary percentage of maximum energy, or at some arbitrary percentage of cleavage fracture.

Examination of the data disclosed that the most satisfactory criterion for the purposes of this examination was one based on percent of cleavage fracture. Therefore, from the curves of percent of cleavage fracture vs. temperature, the temperature corresponding to 90% cleavage fracture was determined. These values are plotted in Fig. 5 to show transition temperature as a function of arsenic content.

Some may wonder if a curve can legitimately be drawn on the basis of data in Fig. 5. But if one were to draw the steepest possible line (as has been done with the dashed line), the slope indicates that 0.01% arsenic raises transition temperature about 2.7 F.

Actually, use of the least-squares method to determine the best straight line that can be drawn through the low-phosphorus data yields a slope of 1.9 F increase in transition temperature per 0.01% arsenic. The data indicate that the effect of arsenic is about the same whether the phosphorus level is low (*dots*) or high (*crosses*).

A further question may be raised as to why high-phosphorus steels have transition temperatures no higher than those of low-phosphorus steels—in other words, why the line for high-phosphorus steels does not lie above

"I got it through an ad in 'Welding Engineer' magazine over on Earth."

the line for low-phosphorus steels, since phosphorus is known to be a potent factor in raising transition temperature.

The answer may be found in the fact that the high-phosphorus ingots 7, 8 and 9 contained only 0.14% carbon; the low-phosphorus ingots contained 0.18 to 0.20% carbon. This occurred in spite of the fact that all heats were made to the same nominal carbon content. Therefore, the expected increase in transition temperature due to the increase in phosphorus content was offset by the decrease in carbon content of the high-phosphorus heat.

In regard to the 2.7 F increase in transition temperature caused by 0.01% arsenic (it must be emphasized that the arsenic may, in fact, be less potent than this), it is interesting to relate results reported by Rinebolt[4]. He states that a 0.01% increase of carbon and phosphorus increases transition temperature of a normalized plain carbon steel 5.2 F and 14 F, respectively. However, a direct comparison between Rinebolt's data and that developed in the recent investigation is impossible because of the sensitivity of impact transition temperature to subtle differences in steel processing—and especially in view of the fact that utilization of a weld bead in the program created more than a subtle difference.

In brief, here are the conclusions reached by the investigators for each phase of the test program:

1. Room-temperature hydrostatic bursting tests of small vessels welded from commercial 45-deg long-radius welding fittings disclosed no significant difference in strength between American fittings containing 0.003% or 0.002% arsenic and the sponsor's fittings containing 0.06% arsenic.

2. Room-temperature hydrostatic bursting tests of small vessels welded from laboratory-melted steels containing arsenic ranging from 0.02% to 0.2% disclosed no effect of arsenic content on strength.

3. The ductile-to-brittle impact transition temperature of an ASTM A106 Grade B base steel containing a weld bead is not appreciably increased by arsenic. The most adverse interpretation of data reported here shows an increase in transition temperature of 2.7 F per 0.01% increase in arsenic content at phosphorus levels of about 0.01% and 0.06%. Therefore, the transition temperature of fittings made from British steel is no more than 16 F higher than that of fittings made from American steel. This is attributed to the difference in arsenic content between the steels and neglects any other compositional difference.

Acknowledgments . . .

This program was sponsored by Canadian Clyde Tube Forgings, Ltd., Toronto, Ontario, Canada, on behalf of Clyde Tube Forgings, Ltd., Glasgow, Scotland. The authors appreciate the sponsor's permission to publish the results.

Table I—Chemical composition and bursting strength of vessels fabricated from commercial fittings

Source	Chemical composition (%) As	C	Mn	P	S	Si	Bursting strength* (psi)
Canadian Co.:	0.060	0.24	0.55	0.016	0.042	0.20	12,500 13,000 11,700
American Co. A:	.003	.22	.69	.004	.030	.22	13,500 14,000 14,200
American Co. B:	.002	.26	.44	.016	.024	.17	12,200 12,300 12,200

*—*Tests run in triplicate*

Table II—Chemical composition of laboratory steels

Heat No.	Ingot No.	Chemical composition (%) As	C	Mn	P	S	Si
A	1	0.020	0.19	0.72	0.009	*	0.34
B	2	.031	.18	.55	.009	*	.22
A	3	.075	.20	.80	.011	*	.40
B	4	.080	.20	.63	.009	*	25
A	5	.107	.20	.70	.009	*	.39
A	6	.201	.19	.66	.012	.016	.38
C	7	.032	.14	.58	.054	.021	.16
C	8	.074	.14	.53	.059	.020	.16
C	9	.092	.14	.45	.065	.021	.15

*—*Not analyzed*

Table III—Bursting strength of vessels fabricated from laboratory steels

Ingot No.	As (%)	P (%)	Bursting strength, psi* A	B	C
1	0.02	0.009	11,200	11,300	11,900
2	.031	.009	10,500[a]	10,900[a]	10,600
3	.075	.011	11,700	11,600[b]	11,600
4	.08	.009	10,400[a]	11,100[a]	10,300[a]
5	.107	.009	12,500	11,400	11,300
6	.201	.012	11,300	11,400	11,400

*—*Triplicate tests*
a—*Sand seams in the machined pipe*
b—*Failed in weld due to lack of fusion (determined by X-ray)*

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THERE ARE EXACTLY 37 different welding methods—and before a welding engineer can resolve any design problem, he must decide which one will best serve his needs.

Such selection not only requires knowledge of these various methods, but knowledge also of the product's service requirements. For example, in many instances the welded product will be inspected upon completion.

Welds made by any of the arc processes can be readily radiographed. However, radiographic inspection is not entirely suitable for flash welds because the welded joint is a narrow line. And again, some welds can be inspected by magnetic particle examination, but still others cannot (*e.g.*, furnace copper brazing).

Equipment portability can also become an important factor in selecting a welding process. On some jobs, large welding machines installed in permanent locations must be used; in other cases, the equipment may be so portable that welding can be performed anywhere.

WELDOR displays correct technique for making vertical groove weld when using manual metal-arc process.

Part III

The fundamentals of *welding engineering*

by **T. B. Jefferson** . . . *Editor and Publisher*

Essentially, welding processes differ from one another in one or more of four distinct areas: *(1)* heat source, *(2)* means of preventing oxidation or other contamination, *(3)* necessity and means of adding weld metal, and *(4)* whether the application of pressure is required.

Major heat source for welding is electric power, which is used in all arc and resistance welding processes, as well as in induction welding and brazing applications.

Other heat sources include electrically-caused molecular breakdown of hydrogen (atomic hydrogen welding); combustion of gas, oxygen and acetylene or oxygen and hydrogen; combustion of coal, carbon or other solids (forge welding); and chemical reactions (thermit welding).

Protection of the molten metal against contamination must be effective to preserve a weld's metallurgical qualities. Shielding agents normally are gases, liquid flux and solid granular flux. Inert gases (helium, argon) and reducing gases (hydrogen, carbon dioxide) are very effective in protecting molten metal from oxygen and nitrogen.

Flux applied as a solid material (*e.g.*, in oxyacetylene brazing) is converted by heat to a liquid which shields the metal against contamination. The third method, solid granular flux, excludes oxygen and nitrogen both by surrounding the arc zone, and by becoming a molten blanket within the arc zone.

Welding processes differ radically in the addition or omission of filler metal. In some, filler metal is a bare wire (*e.g.*, oxyacetylene, atomic hydrogen and Tig welding), while in the shielded metal-arc process, the filler is a coated electrode. In other processes, such as resistance welding, no filler metal is required.

Processes also differ in the method of pressure application. All resistance welding processes require pressure, and the success and quality of the weld will depend largely on the correct pressure at the proper time in the welding cycle. Pressure is applied intermittently in some resistance welding processes, while in others pressure is constant or is provided by a single blow.

In arc welding, the heat-producing electric arc is obtained from a low-voltage, high-amperage current jumping an air gap. The intensely bright arc may be 7,000 F, though it is usually less.

There are 12 arc-welding methods which can be divided into two major groups: metal-arc and carbon-arc. All may be used automatically or manually.

In metal-arc welding, the electrode gradually melts away and is carried across the gap by the arc to become filler metal. Electrodes may be coated or uncoated, but the former is preferred for these reasons: *(1)* more stable arc; *(2)* increased welding speed; *(3)* smoother weld beads, and *(4)* substantial improvement in mechanical properties of weld metal.

In carbon-arc welding, an arc is established between a carbon electrode and base metal. The arc provides heat for metal fusion, but does not carry filler to the weld. Filler metal is added by melting a coated or bare welding rod which usually corresponds in analysis to the base

metal. (Since carbon-arc provides its own protective atmosphere, the bare electrode is preferred.)

Another type of carbon-arc welding produces an arc between twin carbon electrodes. This is a soft arc similar to a torch flame.

The original inert-gas-shielded process, Tig (tungsten inert-gas) welding, establishes an arc between base metal and a single tungsten electrode, while inert-gas flows around the weld area to prevent oxidation. Filler metal may or may not be added to the joint.

A variation of this process uses a metal (consumable) electrode and is called Mig (metal inert-gas) welding. A special "welding gun" automatically feeds filler wire to the work. These two processes are best used when welding aluminum, magnesium, copper and stainless steel.

Atomic hydrogen, a forerunner of the inert-gas processes, uses two tungsten electrodes. The arc is produced in a stream of flowing hydrogen which becomes ionized, breaks down into atoms, and absorbs large quantities of heat. Contacting the base metal, the atoms return to the molecular state and release all the absorbed energy. Arc temperatures range between 7,254 and 10,000 F. Addition of filler metal is optional.

In submerged-arc welding, a granular flux composition is spread over the joint to be welded just ahead of the bare filler wire. Heat from the arc causes local melting of flux, base metal, and filler wire.

With this process, thick pieces of metal can be joined in a single pass at relatively high speed, and higher welding currents minimize distortion.

A flammable gas burned with pure oxygen produces sufficient heat for welding. The fuel gas is usually acetylene (oxyacetylene welding) or hydrogen (oxyhydrogen welding), but may also be natural gas, manufactured gas, propane or butane. (The last four are used primarily for brazing and for welding metals and alloys with low melting points.)

Flame temperatures for oxyacetylene welding range from 5,800 to 6,300 F, depending on the ratio of oxygen to acetylene. Oxyhydrogen flame temperature is about 5,000 F, while natural gas, propane or butane with oxygen will produce temperatures of approximately 5,300 F. (Acetylene flame temperature in compressed air is about 3,400—too cold to melt steel satisfactorily.)

The torch flame not only produces the desired welding heat, but also shields the weld joint and filler metal. Usually, a filler rod is used with this process and is of the same, or nearly the same, analysis as the base metal.

CARBON-arc lead welding is only one of the 37 various welding methods listed on the master chart. Knowledge of all methods is necessary before a welding engineer can resolve any design problem.

Resistance welding is based on the principle of heat development caused by the natural resistance of metal to electrical current passed through it. Resistance to current is greatest at the joint interface, and it is here that the metal reaches fusion temperature. Pressure is then applied to weld the parts solidly but locally.

Success of any type of resistance welding depends on accurate current control, and demands proper interruption of the current flow at split-second intervals.

The most common resistance process is spot welding. Thin sheets to be welded are placed between movable copper-alloyed electrodes which can be actuated to apply proper pressure while providing current for the development of welding heat.

Seam welding is basically spot welding but utilizes one or two wheel-shaped electrodes, which can move at relatively high speeds along straight joints. The spot welds normally made by these units actually overlap, producing a gas- and water-tight seam. However, the welds can also be spaced far apart to create a series of spots.

Projection welding is another resistance method and differs from the two cited above in that projections or embossments on parts being welded localize current flow and welding heat at predetermined points. It is used principally with punched, stamped or formed parts, and the embossment, of course, is formed during stamping.

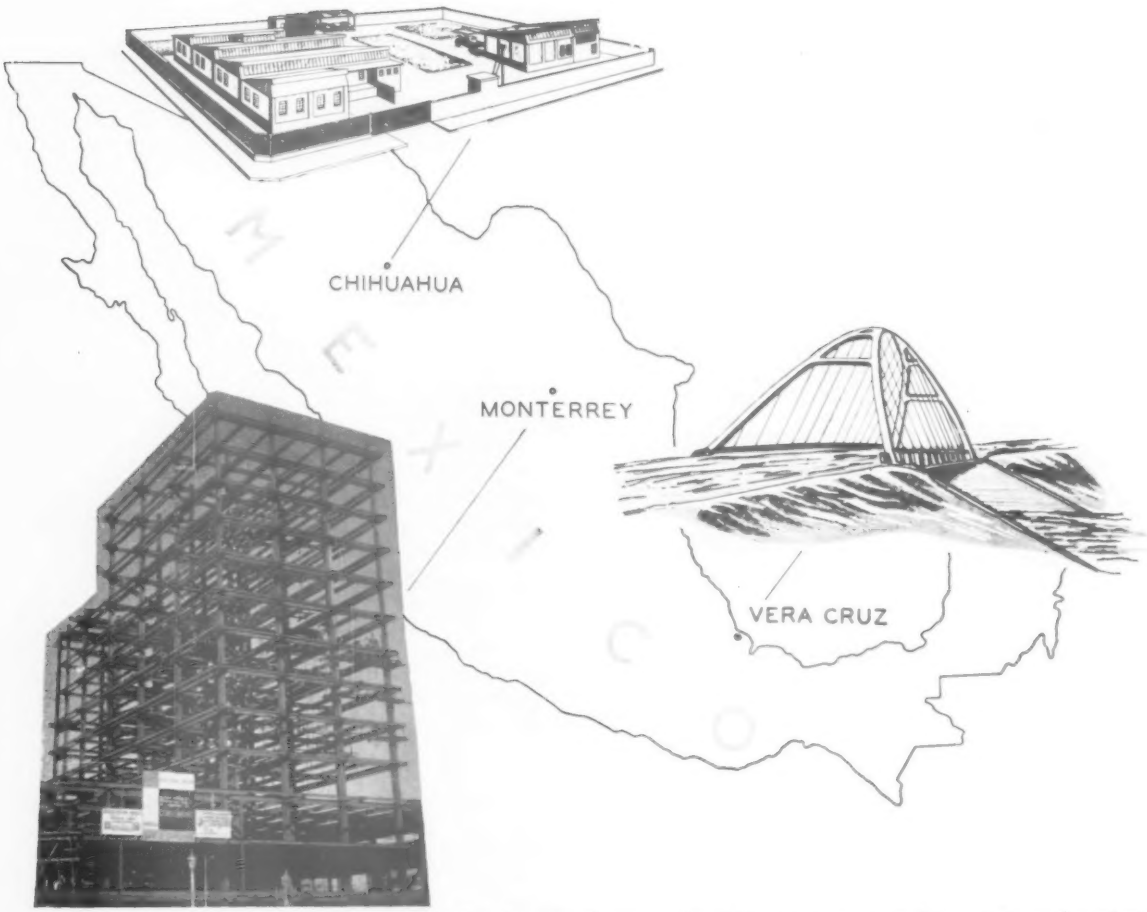
Resistance butt welding joins two pieces end to end by passing current through the gap between the parts, which are then forced together under pressure. Actual stock sizes joined by this method are determined by equipment at hand and available current.

A more complicated form of butt welding is flash welding. Parts are first brought together under light pressure and current is passed through them. A high, localized heat and a shower of sparks results. This flashing continues until the ends are plastic, then they are butted. A portion of the metal is squeezed out to form a burr which is trimmed, leaving a relatively small area for grinding and finishing.

Thermit welding is based on a chemical reaction between aluminum and iron oxide. A mold with a pouring gate at the top is built around the parts to be welded. The thermit charge, iron oxide with alloying elements plus granulated aluminum, is ignited in a crucible. Reaction produces high heat energy, and molten steel at 5,000 F flows into the mold to fuse the parts.

(Although forge welding was used by the blacksmith of yesteryear, it holds little advantage for production today. However, it is still considered a legitimate welding method.)

Brazing and the newer processes used in the welding industry will be discussed in the next chapter in this series.



IN the illustration above are three examples of Mexican progress. At the top is the modern plant of Oxigeno de Chihuahua; in Monterrey, it's the new Banco Popular building, and in Vera Cruz state, the all-welded bridge on the Rio Blanco (see text).

Mexico is on its way UP

in the world of welding

by **Eric Holby**

PARALLELING extraordinary progress in virtually all fields of Mexican industry is the impressive growth of that country's welding industry.

Welding equipment and supply production . . . new constructions with extensive use of welding . . . weldor training programs: all have vastly increased in the past decade and show promise of continued growth.

Taken one by one, here is the way in which these specific growth areas are affecting the industrial and economic picture in Mexico.

Table 1 indicates that, in 1954 and '55—the most recent years for which accurate figures are available—Mexican consumption of acetylene and oxygen was only about 10% of U. S. usage. Yet there is a striking similarity in productive growth in the two countries.

In Mexico, four industrial groups produce industrial gases:

1—Cia. Productora de Oxigeno, with its subsidiaries: Electrodos Monterrey (Mexico City); Oxigeno de Chihuahua (Chihuahua), and Gases y Electrodos (Torreon);

2—Cia. Mexicana de Soldadura;

3—Cia. Mexicana Aga;

4—Gases Mexicanos.

The last three firms also have subsidiaries in the more important cities of Mexico. All of these companies use fractional distillation of air to produce oxygen, which is distributed in steel cylinders.

Liquid oxygen, currently nonexistent in Mexico, will soon be produced by Argon de Monterrey, S.A., which is now constructing the necessary facilities. Liquid argon also

will be produced by this firm, as will nitrogen.

(Argon de Monterrey is one of five Mexican gas-producing firms in which NCG International, C. A., a subsidiary of Chemetron Corp. of Chicago, has acquired substantial interest. Other companies involved in the recent transaction are Cia. Productora de Oxigeno, S. A., and its three subsidiaries listed above.)

TABLE I

Acetylene production (cu ft)		Oxygen production (cu ft)	
Mexico:		*Mexico:*	
1954	6,456,000	1954	22,344,000
1955	8,772,000	1955	29,980,000
United States:		*United States:*	
1954	6,197,000,000	1954	22,073,600,000
1955	8,204,317,000	1955	29,091,873,000

As recently as 10 years ago, Mexican production of electrodes for applications on steel and cast iron, and for hardfacing, was limited to just a few types. Electrodes imported from the U. S. were the most widely used filler metals.

Today, however, the list of filler metals produced within the country is truly impressive. There are types for low-carbon steel (corresponding to AWS designations E6010 through 6013, plus E4511), and others for low-alloy high-strength steels (corresponding to our E7010 and higher). The latter compare favorably with imported types.

Mexico still does not produce stainless steel electrodes, wire for automatic welding, or flux. These items are imported principally from the U. S., England, Germany and Sweden (see Table II).

Good quality hardfacing electrodes also are being produced in Mexico, and among these are the many types made by Electrodos Monterrey.

Though it doesn't manufacture welding wire, Mexico does make considerable use of the automatic submerged-arc welding process. A constantly increasing number of these units are in use in Mexico City, San Luis Potosi, Puebla and Guadalajara.

In Monterrey, three gas producers —Cilindros, Tanques Monterrey, and Cilindros Monterrey—use this process in fabricating butane gas cylinders. Another large firm, Tubacero, employs several submerged-arc units in constructing pipelines up to 12 in. in diameter.

Submerged-arc welders also see general use throughout Mexico as maintenance tools. Steel rolls and worn tractor tracks frequently are built-up with the process.

Resistance welding is still another process that is growing in popularity wherever it can be used. (A shortage of suitable power in many areas of Mexico either prevents the use of resistance welding machines, or limits their size.)

Spot welding, of course, is the most widely used resistance method, and it is applied principally to light-gage sheet steel in fabricating such appliances as kitchen cabinets, stoves, refrigerators, washing machines and air conditioners. Auto bodies also are spot welded.

Several American firms export resistance welding machines to Mexico, since the country builds its own units only on a small scale. Peer Co. of Benton Harbor, Mich., for example, markets a complete line of resistance welding equipment there through its export division, Exportadora.

Concepts of construction have been radically altered by the growth of welding in Mexico. In many instances, welding is replacing riveting, creating notable reductions in time, materials, labor and noise.

The fact that welding permits a weight reduction without sacrificing structural strength made it a popular choice in the construction of Mexico City's enormous auditorium. Engineers were faced with the difficult problem of erecting the building on marshy ground.

By selecting welding as their joining method, these engineers cut the weight of necessary steelwork by almost 50% over the amount that would have been needed for riveted construction. Longest spans in this $360,000 building are 328 ft in length. The contractor for the auditorium reports that 6,000 tons of steel were welded with Mexican-made E6010 and 6012 electrodes. All work

TABLE II

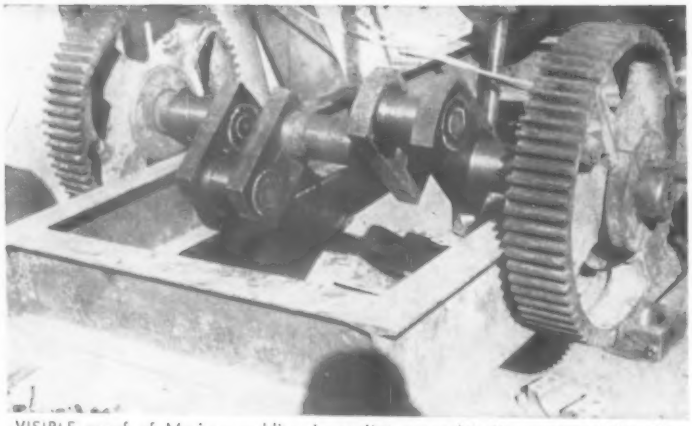
Mexican imports of welding supplies for 1956*

(principal suppliers only)

Products and countries	Pounds	Dollar Value
Iron, steel wire for gas welding (cut to size, uncoated)	357,720	$103,805.12
United States	353,304	103,144.88
Sweden	4,416	660.24
Iron, steel arc welding electrodes	579,181	264,584.48
United States	575,636	259,610.80
Germany	3,007	1,904.48
Aluminum wire for gas, Mig and Tig welding	16,956	9,038.32
United States	15,876	8,229.12
Low Countries	963	691.12
Copper, copper alloys (all classes) for gas, arc, resistance welding	55,976	80,912.96
United States	52,626	77,746.40
Great Britain	2,460	2,005.20
Lead-tin solders & soldering fluxes	51,363	34,508.24
United States	43,048	27,684.16
Great Britain	8,251	6,777.76

*Data supplied by the Office of the General of the Technical Statistical Dept., Secretary of Economy, Mexico.

PRACTICAL welding clinics and exhibits are an important part of Mexico's educational program. Metallizing gun is demonstrated here for interested audience.



VISIBLE proof of Mexican welding ingenuity: a crankshaft constructed by Cia. Elias Okon (Torreon) to drive mud jack. Welding time was 32 man-hours—2 men working 2 days. Total cost was a nominal $120, and included 40 lb of electrodes.

was planned and directed by Mexican engineers and technicians.

Two further examples of the outstanding work being done by welding in Mexico are pictured on the first page of this article. One is an all-welded steel bridge over the Rio Blanco (White River) in the state of Vera Cruz; the other is a 90%-welded structure just completed for the Banco Popular in Monterrey.

Although the Rio Blanco bridge was completed six years ago, its bold and original design is very much up-to-date. The structure has two notable characteristics:

1—The two, lightweight lateral arcs (250-ft spans) are joined in the center to form a spacial structure which helped eliminate the need for many structural cables.

2—An arrangement of diagonal beams gives the floor outstanding advantages of rigidity and economy.

This structure is considered by many who have studied its design to be a notable example of modern bridge architecture. It has demonstrated the fact that design freedom which once existed only for users of concrete, may nowadays be obtained with steel construction as well—thanks to the great progress being made in welding knowledge.

Monterrey's new, welded-steel structure will house 22 separate firms upon completion of its interior decoration. Estimates place the amount of structural steel in this 250-ft-high building at slightly more than 2,000 tons—25 to 35% less steel than would have been needed for other erection methods.

Curtain-wall construction, utilizing 16,732 sq ft of aluminum sheets supplied by a Mexican firm, is just one of the many up-to-date features of this building. It is fully air-conditioned . . . on the facade are stainless steel window frames and fixed panels of porcelainized steel with fibre-glass insulation . . . and all concrete used in construction is a special lightweight type. Total cost of the building is approximately $2,320,000.

An obvious need arising from Mexican industrial development has been the one for more and better-trained welding engineers, specialists and technicians, and for weldors. It is a need that has existed for more than two decades, and one which led Cia. Productora de Oxigeno and its subsidiaries to sponsor the formation of an educational society in 1940.

This society, Instituto Nacional, has established four welding schools (Escuelas Practicas de Soldadura) in Mexico City, Chihuahua, Torreon and Monterrey. The Monterrey school now has an enrollment of nearly 100 students in its gas and arc welding courses. In addition to welding practice, these weldor trainees also study mathematics, mechanical drawing and welding theory.

In each of the schools, students learn to use both gas and arc methods in joining steel sheet and plate, cast iron and pipe. Gas welding students must also weld aluminum.

The six-month courses are divided into 20 lessons, which include shop work and theory. Fees are nominal: a course in oxyacetylene welding costs 75 pesos ($6.00) a month, and for arc welding the charge is 125 pesos ($10.00) per month. The schools are in session 17 hours each day, and hours are individually arranged so students may hold regular jobs while studying.

Each school maintains close contact with industries in its locale that use welding. Each is familiar with the problems of local industry, and is able to specially train students to fit them for the particular needs of these companies.

Production weldors in Monterrey or Mexico City may receive 25 to 30 pesos ($2.00 to $2.40) per day. This income is less, for example, than that of physicians who often charge 10 pesos ($0.80) for an office call. But it is considerably better than that of unskilled laborers, who earn less than $1.00 a day.

Instituto Nacional has helped found other welding schools—one in Parras, which is sponsored by Cia. Industrial de Parras, and one in Madero, which is sponsored by Pemex. (Pemex, or Petroleos Mexicanos, was established in 1938 by the Mexican government, and is the only oil company permitted to operate in Mexico.)

Also promoted by the Institute is the organization of welding conferences, and of practical demonstrations, exhibitions and clinics. Films shown to students in all of the country's welding schools is still another phase of the Institute's educational program.

Stress relief by-passed on ship

Time short—
equipment lacking—
work pressing—

By Grover A. Hughes
Head Welding Engineer
San Francisco Naval Shipyard

DURING A ROUTINE inspection of a Navy carrier preparing to sail from the San Francisco Naval Shipyard, a fissure was discovered inside a large steam receiver.

The crack began on the toe of the nozzle's fillet weld and ran around the nozzle approximately 270 deg. In depth, it was almost halfway through the 1 3/8-in.-thick receiver shell.

Repairing the receiver presented a major problem. Its size—vertical, approximately 6 ft. in diameter and 25 ft. high—was so great that available stress relief furnaces were not large enough to heat it . . . and our induction heating equipment was inadequate.

Time, too, was a factor. To dismantle the receiver, remove damaged shell area, weld, stress-relieve, and reinstall aboard ship, would have taken more time than was available.

Torch Stress-relief?

Stress-relieving with torches was not feasible. Torches would cause unequal metal expansion and possibly increase stresses in areas that might already be highly stressed because of repair welding.

It was decided to explore the possibilities of cutting a U-shaped section from the receiver and welding in—aboard ship—a new plate and nozzle. This would avoid costly repairs and awkward clearances.

The stress relieving problem might be solved by using high preheat and low postheat on the ASME-SA 212B boiler plate.

Our ideas were based on research conducted in 1946. This research sought the optimum of butt welding and fillet welding of mild and medium steel.

Further experiments had been made to determine correct electrode sizes and number of passes (It is known that distortion and residual stresses in a welded joint increase as the number of passes increase.) for each plate thickness in each welding position on each size butt and fillet joint.

Researchers observed that distortion decreases with uniform preheat increase and, at the highest preheat used—400 F—distortion was only a fraction of that on mild or medium steel when welding at 70 F.

Decreased Stresses

As distortion decreases so do residual stresses. Therefore, a low postheat treatment should be satisfactory for producing sound welds.

Based on this, one theory was advanced that, if high preheat temperature is maintained throughout welding, no postheat treatment would be required.

In order to examine this idea, six test coupons of the same material as that to be welded were obtained. These pieces were 30-in.-long, 5-in.-wide, and 1 3/8-in.-wide. The 30-in.-lengths were at right angles to the direction of rolling.

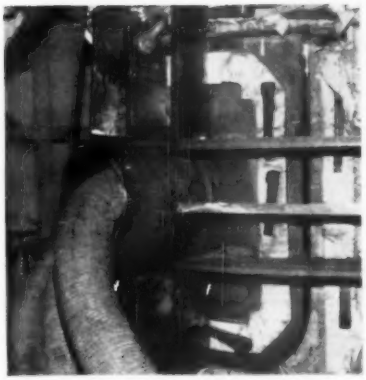
Edge preparation consisted of a double Vee joint, each with a 90 deg. included angle, a 1/8-in.-nose, and a 5/32-in.-root opening.

As welding on the actual receiver would include two joints in a vertical welding position and two joints in a horizontal welding position, all test welds were made horizontally, this being the difficult position; particularly because the closing weld would be made horizontally and be highly restrained.

Electrode Size

To approximate this closing weld, steel pieces were inserted between the ends of the test plates. The ends were then welded with maximum restraint. All welding was done by block sequence: the middle block welded first, then the remaining blocks.

Electrode used was MIL-E-18038 (Ships) 7016, an equivalent to AWS E7016. The root pass was laid with a 5/32.-in.-electrode and not peened. The second pass was made with the same electrode, but peened.



INTERIOR of receiver with 3,000 watt strip heaters in place.

The final passes used a 3/16-in.-electrode and were peened, except the last pass. In all, 12 passes were made. Turning the test piece, the root pass was chipped and the same welding sequence followed.

One plate was welded at room temperature with interpass temperature held below 100 F.

One plate was preheated to 200 F, and this temperature maintained throughout welding.

One plate was preheated to 400 F, which temperature was again maintained throughout welding.

Each plate was cut into three pieces. One piece of each plate received no postheat treatment. One piece of each plate was heated to 800 F and held for an hour before being furnace cooled. The remaining section of each plate was heated to 1,150 F, held for an hour, and furnace cooled.

The nine pieces, and one unheated segment kept as a control, were sent to the metallurgist for tensile, bend, and hardness tests.

Metallurgical Properties

The testers worked with flat 1-in.-wide pieces taken from the metal and 0.505 in. sections. Tensile strength results, shown in Table I, although not conclusive, do give indications of trends when welding with low, medium, and high preheat.

In the flat 1-in.-wide specimens, there was little difference in yield and ultimate strengths in pieces with no postheat treatment and those post-

FINISHED weld—strip heaters removed—ready for inspection.

heated at 1,150 F.

Elongation was approximately the same in non-postheated specimens and specimens postheat treated at 800 F. However, postheat at 1,150 F showed a natural higher value in percentage of elongation in 1 in.

One thing was outstanding at high preheat: warpage was less at 400 F. Less warpage indicated that lock-up stresses were lower in specimens welded at this temperature.

This tended to bear out theories that no postheat treatment is necessary if preheat temperatures are high enough.

Yield, ultimate tensile, and elongation results in 0.505-in. specimens were not so varied as in the 1-in. specimens. Generally, they followed the same trend. Ductility was about the same in the as-welded condition and at 800 F, but increased when postheat treated at 1,150 F.

Bend Tests

Welded sections were also given face and root bend tests. Preparation for this included machining weld reinforcement from the specimen and sawing the section through the center of the weld. The unit was then bent around a $\frac{7}{8}$-in. pin.

A stress-relief postheat of 800 F showed no advantage over sections bent in the as-welded condition—400 F preheat specimens gave satisfactory bend tests.

Hardness tests, too, were conducted. These were based on the 30 T Rockwell scale.

No significant differences were noted in base metal, weld metal and affected zones of hardness in specimens preheated at the three temperatures.

The 1,150 F treatment lowered weld hardness and HAZ somewhat, as would be expected. In all specimens, moreover, weld metal was harder than the base metal and the heat-affected zone was either equal to, or harder than, the weld.

In no case did welding heat cause excessive hardening or softening of the base metal.

Results of these tests proved 400 F preheat—without subsequent stress-relieving—gave satisfactory results.

Heat Protection

We decided, therefore, to use this temperature on the job . . . if weldors could withstand the intense heat. To this end, we took a number of precautions in matters of dress, air, and weldors' physical condition.

Before a weldor was allowed to work in this heat, he was required to pass a physical examination. Another examination was given following welding.

Special, protective clothing was made of rayon and fiberglas, using aluminum foil to reflect radiant heat. Belts fitted with air hoses were given to each weldor to cool suit fronts.

In addition to this, welding hoods had air hoses attached to supply cool air inside. One further step was taken—blowing air through the receiver access opening and exhausting it through the nozzle.

With these precautions, actual air temperature at the receiver's top was 170 F. Weldors worked in 30 minute relays with no injury or serious discomfort.

Bringing to Temperature

By fastening 3,000-watt strip heaters to the outer and inner shell of the receiver, and raising the temperature 60 deg each hour, we reached 400 F in a little over six hours. This temperature was held during welding, except when welding outside the receiver, when heat was raised to 450 F.

After all welding was completed, the receiver was subjected to a hydrostatic test to uncover any leaks.

Then all welds were inspected by magnetic particles and, finally, examined 100% by X-rays.

All welds were found free of cracks or defects.

TABLE I

Results of Tensile Tests

Spec. No.	Preheat, F	Stress relief, F	Tensile str. psi	Yield stress, psi	Elongation % in 2 in.	Elongation % in 4 in.	Warpage degrees
				Flat Specimens			
1A	None	None	74,400	38,300	21	7	2.5
1A	None	None	67,400	33,000	22	8	
1B	None	800	73,900	32,000	22	9.5	3 .5
1B	None	800	74,750	38,200	22.5	8.5	
1C	None	1,150	72,800	36,500	24.5	13	3
1C	None	1,150	72,800	38,000	23	9	

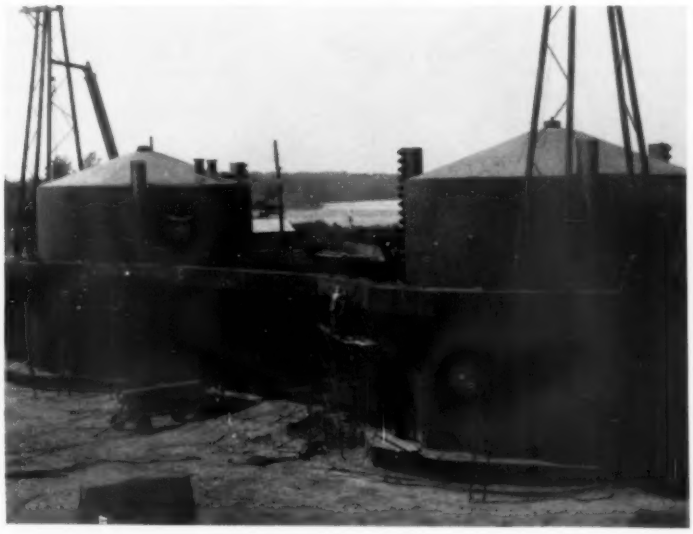
FIFTY tons with one bite is capacity for this all-welded electric log stacker. Built for rough-terrain, the fork lift machinery can unload and transport logs to nearby mill or storage areas with little effort.

R. G. LeTourneau Inc. welds . . .

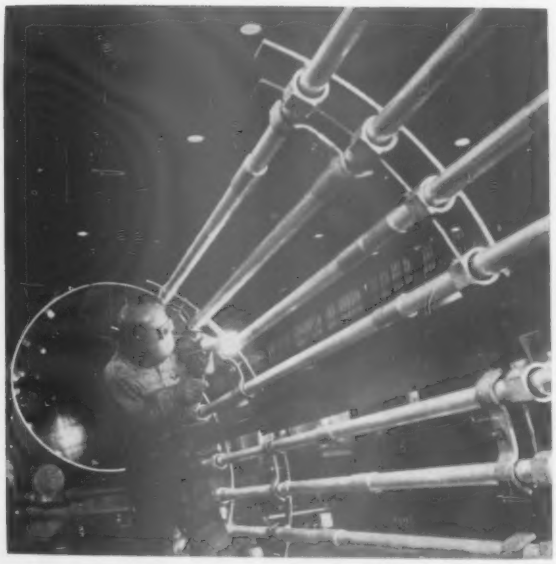
Gulliver-size machinery

WELDING detail can be seen on off-road transportation vehicle. Two major types were developed: multi-unit "trains" with all-wheel drive and single-unit six-wheel "transporters." Two of the "trains" are now in use in the Arctic.

POWER-rotated jib crane is also all-welded. Cranes and hoists built by the company for its own use are also available to industry. Other tools fabricated by the company include lathes, presses and milling machines.



BARGE section of mobile off-shore platform is all-welded. Vertical rows of short horizontal bars located at intervals on the large upper and lower horizontal members are strap welds. The gigantic "portable islands" can raise themselves 10 stories within two hours.



TIG: manual Tig torch is used by this weldor to make strong, leak-proof joints on interior aluminum heating coils for special railroad tank cars.

MIG: fully-mechanized Mig unit joins longitudinal seam on tank-car. Long boom holding welder and carriages moving tank work together to permit continuous weld.

TIG CUTTING: production time is slashed from 14 man-hours to half an hour with Tig cutting torch, used here to cut manway opening in dome head.

ALUMINUM TANK CARS

Faster . . . and faster, thanks to Tig and Mig

YEAR AFTER YEAR, aluminum railroad tank cars have been turned out faster and faster at the Sharon, Pa., plant of General American Transportation Corp. This improvement is largely due to the extensive use of two modern welding processes — Mig and Tig — and Tig cutting.

The tanks are made from aluminum because they carry acids and other chemicals . . . cargos that would rapidly corrode a carbon-steel tank. In addition, the aluminum saves weight and is easier to maintain.

A major bottleneck in tank car fabrication was overcome with the introduction of the Tig cutting process. Formerly, manways and other openings were burned through with metal-arc welding electrodes, then chipped to the correct diameter.

Today, Tig cutting enables *one* man to do in *30 minutes* what *four* men previously did in *3½ hours*. In addition to these remarkable savings in time and labor, all cutting is now done at one station on the production line . . . and the smooth Tig cuts require no chipping, grinding or other finishing operations.

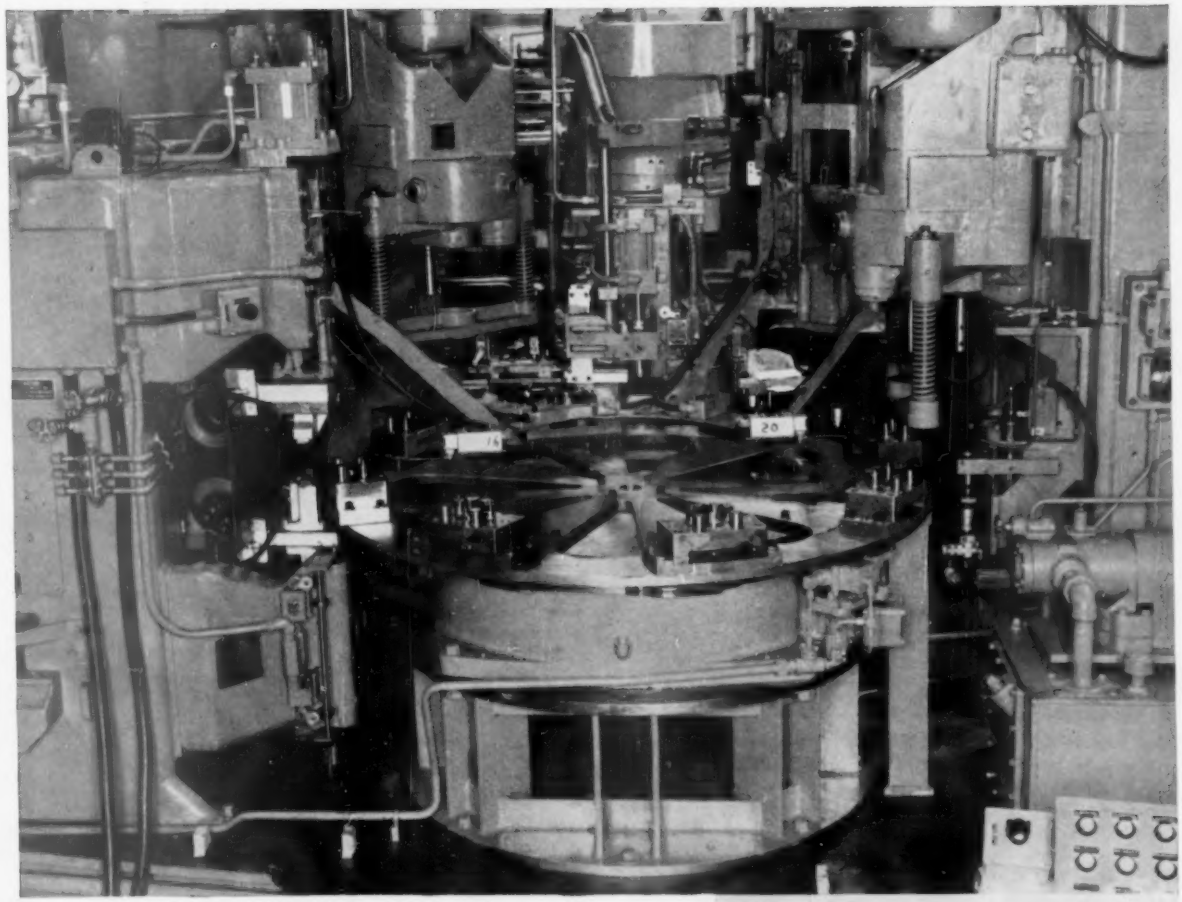
High-speed production and X-ray quality welds are obtained through the exclusive use of Mig and Tig welding (equipment for which was supplied by Linde Co.). Semiautomatic Mig welding machines tack weld fittings and subassemblies. Easily carried to the point of use on crane hooks, the machines are ideal for welding in hard-to-reach places—such as those inside the tank after it has been assembled.

Fully-mechanized Mig units are used to make circumferential and longitudinal seam welds, both inside and outside the tank. Tanks are positioned by motorized rolls and carriages. The stationary boom that mounts the Mig welding head is long enough to reach the inside seam.

Manual Tig torches are used on some unusual jobs—*e.g.*, fabricating interior heating coils for special tanks—and they do the work quickly and economically.

Welding speeds for both manual and mechanized processes average about 12 in. per minute, with current requirements ranging from 335 to 470 amp and from 25 to 28 volts. The material—5052, 5254, and high-purity aluminum—varies from ⅝- to 1¼-in. thick.

Since 1928, when General American built the first aluminum railroad tank car, demand for the cars has increased tremendously. And as new processes for welding and cutting aluminum have been developed, each has enabled General American to build a better product faster . . . and at less cost.



THIS NATIONAL ELECTRIC MULTI-STATION DIAL FEED MACHINE

paid for itself in 9 months!

Loading, resistance welding, hydraulic reaming, hopper feeding, pressing, hot upsetting and hollow milling are the seven operations—performed automatically—on automotive brake backing plates by this one National Electric Dial Feed Machine. The installation of this unit, by an automobile manufacturer, not only released eight machines for other production, but saved a corresponding amount of floor space as well.

This is only one example of the money and man-hour savings realized when National Electric Automatic Welding Machines are employed. National Resistance Welders, Gas-shielded Arc Welders and Submerged Arc Welders . . . meet the high-speed assembly-line methods and close tolerances demanded throughout American Industry. A National Electric Welding Machine can be developed to fill requirements of any volume welding job. Write today for information.

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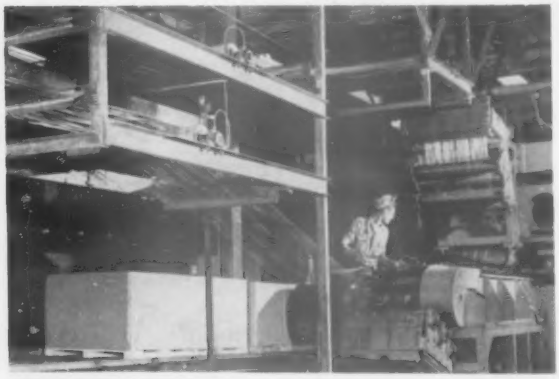
Condensers "woven" in 4 steps

Welding points the way to efficiency

STEP ONE . . . Major differences between the refrigerator of the 1920's and the efficient units of today are not always apparent to the housewife. Styling she sees, and she knows her refrigerator is better, but many modern technical advantages are

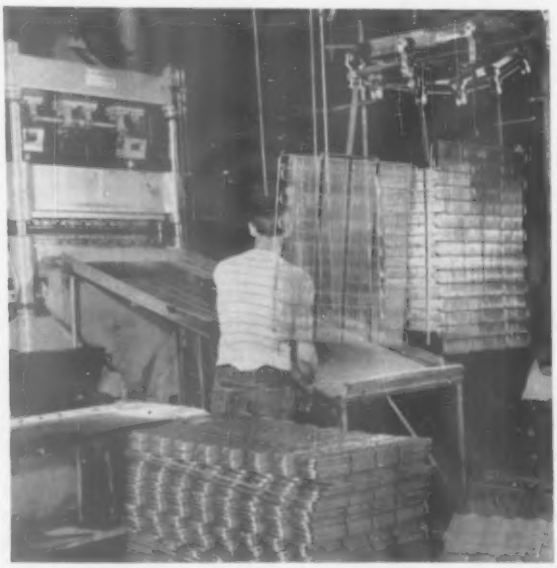
not before her eyes. Witness the 1958 Westinghouse models. In these units, one of the greatest advances in efficient operation is not visible since it is in the condenser. Yet there is a giant step from condenser tubing attached to steel sheet used years ago to condenser tubing resistance welded to wire frames. To Westinghouse and to the consumer, the change means faster production, less weight and better performance. In this photo, which shows the beginning of the welding operation, as many as 168 steel wires with 0.0475-in. diameters are being drawn from drums into a shuttle which supplies the spot welder. Overhead straighteners and pulleys guard against kinks and bends. Worker in background is welding wire ends to insure continuous flow to the welder.



STEP TWO . . . Here, at the feeding port of the resistance welder, wire is drawn into the machine from above and below, giving the appearance of an old-fashioned loom put to modern use. In the welder, the wire will be spot welded to preformed, copper-coated, steel condenser tubing to form a framework that will later be attached to the rear of the refrigerator. Welds are made on both sides of the frame, which will be cut to size before being discharged from the machine. Sizes used at the Columbus, Ohio, appliance plant range from 22, 30, 38 and 42 in., to be mounted in various capacity and type refrigerators.

STEP THREE . . . A closer look at the feeding port reveals a copper-coated steel frame being placed on the conveyor. Wires coming from above will be welded to its top; wires from below will be joined to its lower portion. Four welding heads do the job—joining wires to two tubes at a time. To facilitate this, the conveyor indexes 4 in. at each stroke. For larger units, extra dies are added to enlarge the contact area. Hydraulically operated, the electrodes are individually equalized to maintain uniform pressure.

STEP FOUR . . . Completed condenser units arrive at the welder's business end. Wires were especially developed by Jones & Laughlin for weldability and uniformity of temper—there can



be no weakening or deformation of the fragile tubes at the welds nor can there be any lessening of temper during welding. After the operation is complete, each condenser is subjected to a 225 psi pressure test to be doubly sure of the tubing's strength at all weld intersections. Since the welder was installed 18 months ago, plant officials estimate enough wire has gone through the machine to encircle the earth—at the equator—several times.

MUREX®

selected for strength and speed in all-welded Miami structure...

● Hurricane-prone Southern Florida, as well as engineers throughout the country, are watching with interest the construction of Miami's new First National Bank building. Originally a 4-story, reinforced concrete structure, it will be topped by a 20-story, masonry covered framework of welded steel—one of the first such all-welded buildings ever erected in Florida's hurricane area.

In the shop fabrication at their Knoxville plant, Allied Structural Steel Company finds welding fast and economical with Murex Speedex Electrodes. In the erection at Miami, the welding cuts construction time, decreases costs, fully satisfies engineering strength requirements.

Speedex U was used for general fabrication, Speedex R for all vertical tack assembly and Speedex LH for flat assembly. The wide selection offered by the Murex line permitted choice of the electrode best suited for each job.

The many types of Murex mild steel, low hydrogen, iron powder, hard surfacing, and stainless electrodes help to simplify all welding operations. Write for your copy of the M&T Electrode Selector — valuable guide for choosing the correct electrode for any application. *Metal & Thermit Corporation, Rahway, N. J.*

MUREX

PRODUCTS FOR BETTER WELDING

Foresee wider scope for CO_2 welding

A direct-current reactance unit for use with C-P, constant wire-speed systems of Mig welding will bring light-gage materials into the "easy-to-weld" sphere

KEY to all-position welding of light-gage materials with CO_2 process is reactance unit (left foreground), which permits successful metal transfer at lower current density. Primarily for use on mild and stainless steels, it also will aid welding of aluminum and other non-ferrous materials.

BECAUSE IT IS CAPABLE of low-cost, high-speed automatic operations, the CO_2 Mig welding process has been rather successful. But certain characteristics have prevented its wider use. These limiting factors are:

(1) deep penetration;
(2) too high a minimum current;
(3) narrow bead; and
(4) high spatter loss.

In its efforts to overcome these difficulties, Westinghouse Electric Corp. has investigated the problem in terms of weld chemistry and metallurgy and, now, the welding machine.

During development of electrode wires of special chemistry or specially coated wires, Westinghouse found that electrical characteristics of the welding power supply have considerable effect on the arc of the CO_2 process.

Mig welding, whether using carbon dioxide or argon as the shielding gas, has been limited to horizontal butt and fillet welds because of the high minimum currents needed to create a spray-type transfer of weld metal. An example: minimum current possible on a 1/16-in. diameter electrode is about 300 amp.

Lower currents result in a globular transfer of electrode metal, and these drops actually short circuit the arc. With a constant-potential machine, this short-circuit current can rise almost instantaneously to about seven times the operating value. These high currents create magnetic forces which tend to break up the drops and throw them out of the arc zone as spatter.

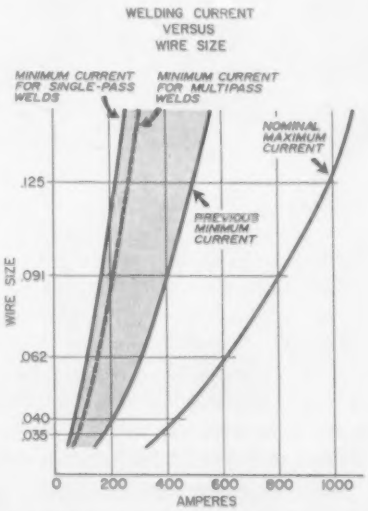
By designing a power supply with more droop, the short-circuit current is limited to a lower value. By addition of a new dynamic reactor to the d-c output of the machine, the rate of current rise under drop-transfer conditions will be limited to a value that allows the drop to be melted off and transferred to the molten pool. (The metal transfer is best described as "droplet" — between globular and spray.)

The value of inductance is selected to produce rapid and repetitive droplet transfer at from 17 to 24 arc volts, depending on wire diameter and d-c ampere setting of the weld power source.

This new power supply makes possible a two-to-one reduction of minimum current on both the carbon-dioxide and argon processes. For example, minimum current on 1/16-in. wire can be reduced from 300 amp to about 100 amp, thus making it possible to achieve all-position welding by either Mig process.

Lower currents not only make possible all-position welding but also lower the minimum material thickness that can be welded. The deep-penetration characteristic limited minimum thickness of butt-welded metal to ⅛ in., using a copper backup bar. Now butt welds can be made on 0.040 material using the same size electrode.

It is true that welding costs increase when welding currents decrease. But Westinghouse says savings effected by this development are such that it allows use of a larger



LOWER minimum currents in Mig processes are made possible with reactor.

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diameter wire at any given current with better bead width, less penetration, better appearance, and at reduced cost (larger diameter wires are cheaper).

Previously both Mig processes have used wires from 0.040 to 0.091 in. at currents from 200 to 600 amp. Now wires from 0.040 to $\frac{1}{8}$-in. diameter can be used at currents ranging from 75 to 800 amp (see graph). In cases where 0.040-in. wire was used at 275 amp, $\frac{1}{8}$-in. wire can now be used at a material cost saving of 4 to 5 cents per pound at present prices.

Credit

This article is based on an interview with officials of Westinghouse's welding department and on a paper authored by H. J. Bichsel, E. J. Steinert and E. R. Gamberg of that department.

Westinghouse views its new reactor unit as "revolutionary," and says "it brings the welding of light-gage materials previously welded by the oxyactylene gas process into the realm of arc welding. At the same time, it accomplishes this at very low cost and with high quality."

Product developments now under way at Westinghouse's welding department utilize electronic timers in conjunction with certain continuous feed hand guns—both air and water cooled—whereby tack, plug or arc-spot welding might become possible in fields "virtually unexplored."

PULL specimen resulted in cup-cone fracture, indicating high quality weld metal. Physical properties of specimen: 73,437 psi tensile strength; 59,150 psi yield strength; 30.85% elongation in 2 in.; 63.62% reduction of area.

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WELDING WIRE FOR HIGH STRENGTH WELDING

Now an entirely new type of *bright* welding wire for MIG and TIG welding processes is available for high strength welding . . . Kaiser Aluminum's King* brand welding wire.

It's available in a complete line of welding rods and electrodes in a broad range of alloys — including new all-purpose alloy 5183, developed specifically for welding the high strength magnesium-bearing aluminum alloys 5083 and 5086.

The consistent high quality of King brand bright finish welding electrodes and rods is achieved by rigid production and inspection controls, including radiographic and destructive testing of actual welds.

Available at leading welding supply distributors across the country. Call your local Kaiser Aluminum sales office, listed in your phone book, for additional information.

Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Avenue, Chicago 11, Illinois.

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Available In A Broad Range Of Alloys		
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	5052	5254
	5356	

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Using standard metal spraying techniques and equipment, Kenspray gives you the most abrasion/corrosion resistant surface ever, plus—faster application using less powder, and a smoother, more uniform, longer-lasting surface.

Kenspray is now available in two grades, suitable for use with most types of standard guns. Overlays may be applied in thicknesses from .010″ to .090″ for fusing at 1950°F . . . can be applied to majority of base metals with melting points above 2000°F. In minimum time, fine finishes may be accomplished with a silicon carbide or diamond grinding wheel.

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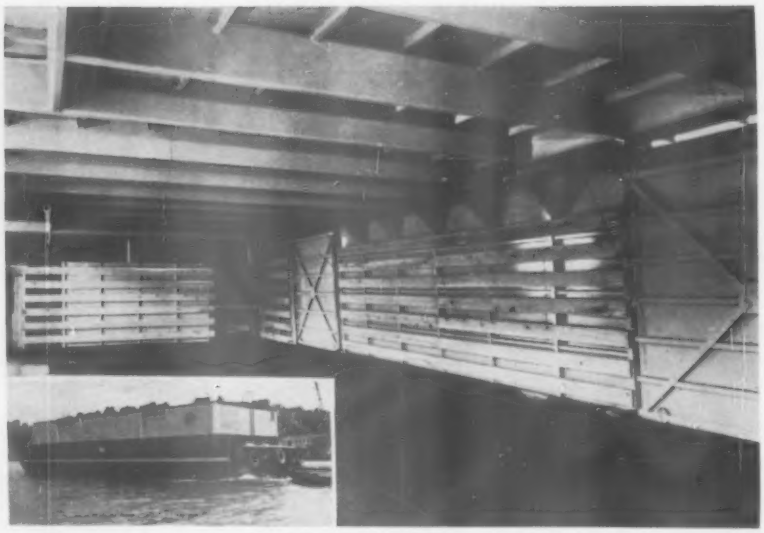


INTERIOR view of deck house on all-welded barge *(inset)* built for the Baltimore and Ohio Railroad. Freight capacity is 300 tons.

New York harbor gets 29 welded barges

DECK HANDS and tug boat crews working on New York Harbor barges will find everything ship-shape aboard 29 steel models recently placed in service by the Baltimore and Ohio Railroad.

The all-welded barges, built by Wiley Mfg. Co., Port Deposit, Md., carry freight to and from steamships and railroad piers. (Also recently completed by the company: six open barges for the Jersey Central Railroad.)

Seventeen barges are covered with deck houses to protect such perishable freight as coffee, sugar and grain from the weather. The remaining 12, called deck scows, are open and used for handling heavy freight not subject to such damage.

Metal-arc and submerged-arc welding were both utilized in fabrication. Electrode types used for metal-arc welding were: E6011, 5/32 and 3/16 in. in diameter; E6013 and 6024, 7/32 in. in diameter; and E6020, in 3/16, 7/32 and ¼-in. diameters.

A semiautomatic submerged-arc gun, mounted on the carriage of a flame-cutting tractor, fed a mild steel welding wire into long seams.

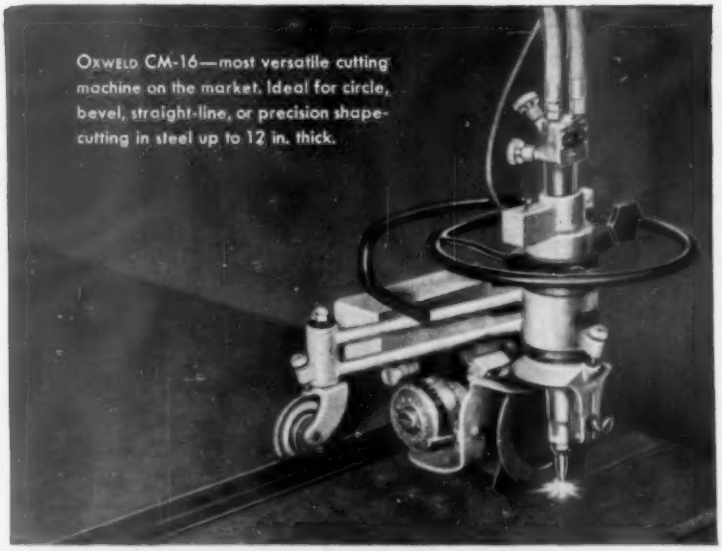
Power sources included 20 motor-generator and 9 a-c welders for metal-arc, each operating at a current of 300 amp, and two m-g units operating at 600 amp for submerged-arc.

Edges of steel plates up to ½ in. thick were given a straight flame-cut for butt welding. Plates from ½ to ¾ in. thick were beveled on one side, and all steel plate more than ¾ in. thick was beveled on both sides. (Flame-cutting was used for beveling, and power wire-brush units for cleaning.)

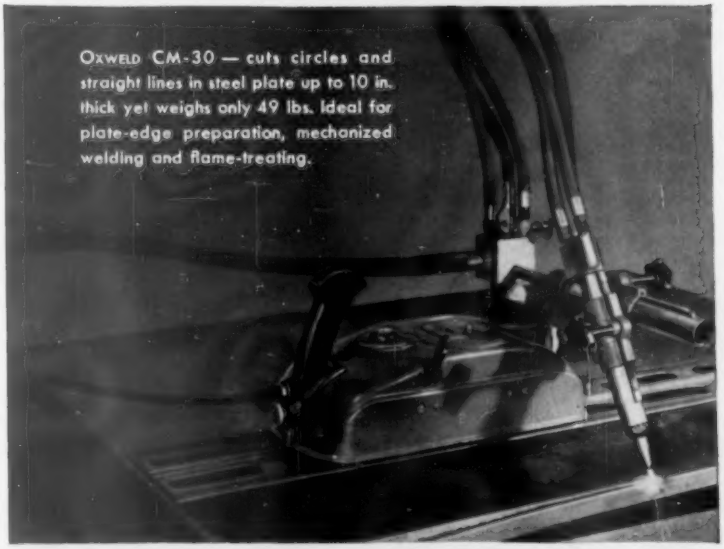
Approximately 70% of welding fabrication was done in the shop; the remaining 30% was completed in the field.

The all-welded barges measure 90 ft long, 30 ft wide and 9 ft 3 in. deep. A covered barge's cargo or deck house measures 76 ft long, 28 ft wide and 11 ft high. Freight capacity for both types is 300 tons.

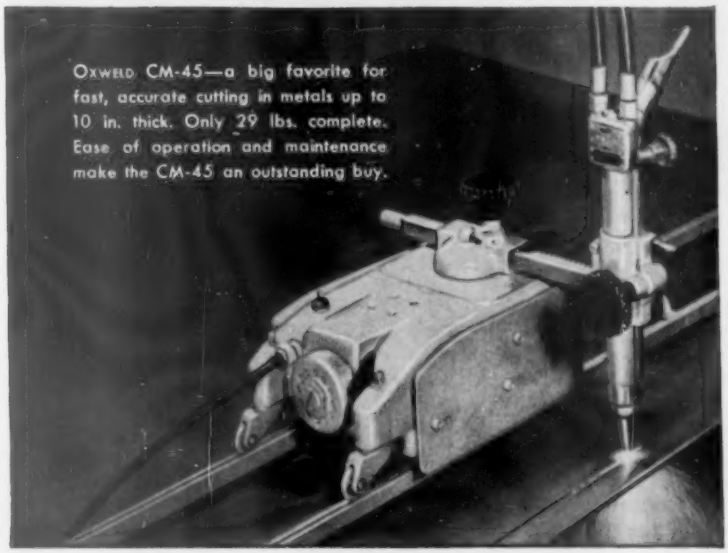
Included in the fabrication of the 29 barges was 1,000 tons of raised, checkered deck plate of ½-in-thick steel. This type of deck provides firm footing for the crew when the decks are wet, as well as added traction for fork lift trucks when loading and unloading.



OXWELD CM-16—most versatile cutting machine on the market. Ideal for circle, bevel, straight-line, or precision shape-cutting in steel up to 12 in. thick.



OXWELD CM-30 — cuts circles and straight lines in steel plate up to 10 in. thick yet weighs only 49 lbs. Ideal for plate-edge preparation, mechanized welding and flame-treating.



OXWELD CM-45—a big favorite for fast, accurate cutting in metals up to 10 in. thick. Only 29 lbs. complete. Ease of operation and maintenance make the CM-45 an outstanding buy.

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PATIENT: In each of these mills are 96 forged-steel hammers. One mill grinds 200 tons of maize daily—creating hammer maintenance problems.

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CURE: Welder replaces worn-away metal. Using reducing oxyacetylene flame with a feather four times inner cone length, he deposits an 1/8-in. alloy layer, which will be ground to size and shape.

MAIZE HAS ALWAYS been a staple crop in America. So ancient is its use that, centuries before explorers beached their boats here, indian women were using crude bowls and pestles to grind corn into flour for their bread.

In modern Mexico, maize is still the main source of flour. So vital is it to citizens' diets that the Mexican government partially subsidizes construction of flour mills.

But progress has been made, and in those mills, the visitor will see no bowls or pestles. Instead, thousands of forged steel hammers pulverize the golden grain into flour.

Modernization, however, creates problems that would astound this

brazed successfully with SILVALOY

LOW TEMPERATURE SILVER BRAZING ALLOY

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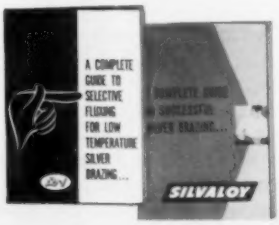
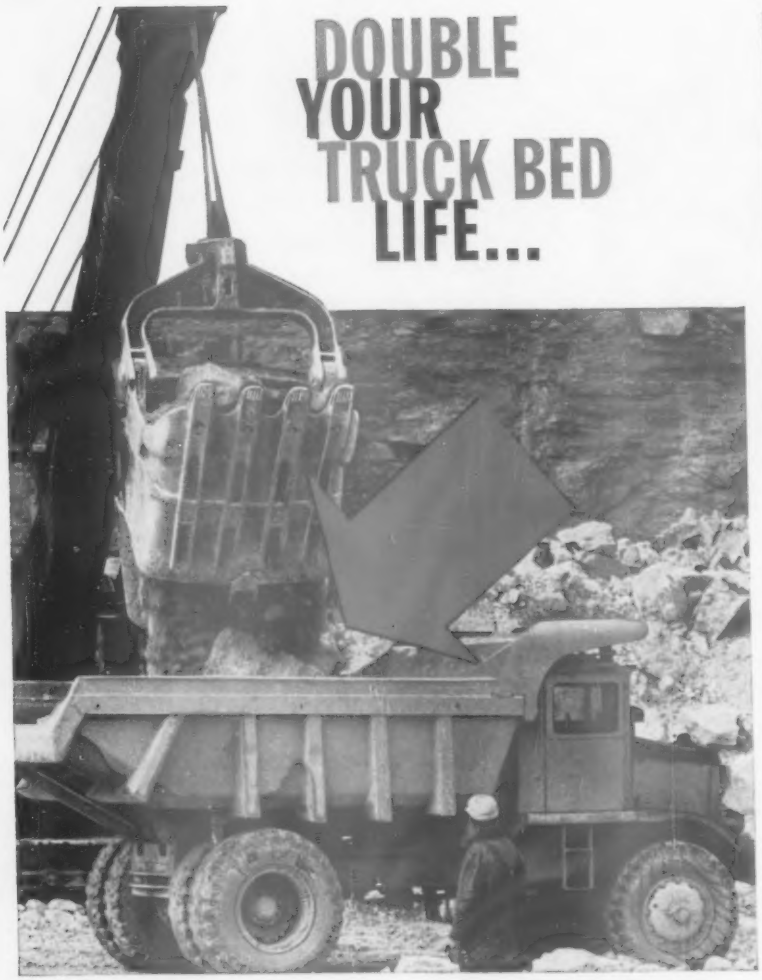


Two complete reference manuals for low-temperature silver brazing and fluxing are available upon request. Send for either one or both. ★ ★ ★ ★ ★ ★ ★



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The company, whose truck is pictured above, lines all new truck beds. Under severe test of a 3½ minute loading cycle, they found that truck-bed life is extended from two to five full seasons.

Amsco manganese steel plate is easy to weld, easy to cut with an oxyacetylene torch.

For additional information, write Amsco Division, Chicago Heights, Ill. Or call your local Amsco distributor.

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continent's early millers. Problems like maintenance, downtime and economy.

One flour producer, Maiz Industrializado, S. A., recently erected one of Mexico's most important plants in the city of Tlalnenpantla. In it are 12 grinding mills—each fitted with 96 forged-steel hammers. Because one mill processes 200 tons of maize daily, the hammers receive an above-average amount of abrasion—despite the fact that their service application cannot be labelled "severe."

Supported on a shaft that rotates inside a cylindrical, hardened steel shell, the hammers have top faces slightly beveled to a knife-like edge. This edge crushes and grinds the maize against the interior surface of the shell. Besides abrasion, there is some impact and corrosion damage to the edges after a time.

Maiz engineers estimate optimum operational efficiency is lost when hammer edges are worn 0.0070 in. As soon as wear reaches this point, the mill is shut down and the units reclaimed.

To maintain hammers at peak efficiency, the firm chose a "Wallex" (Wall Colmonoy Corp.) hardfacing alloy. This is an iron-base alloy containing chromium, molybdenum, manganese and silicon, which gives an overlay hardness from 56 to 60 Rockwell C scale.

Although the hammers to be hardfaced are of different sizes, a typical hammer has a working area 3 in. long by 1 in. thick and 1 in. deep. The beveled face is prepared for hardfacing by undercutting it enough to permit a ⅛-in. layer of hardfacing material.

The alloy is applied in the form of a 3/16-in. diameter rod using a reducing oxyacetylene flame with a feather about four times the length of the inner cone.

After the base metal is brought to a "sweating" temperature, the rod is deposited, aided by a flux for easier application. Maiz finds that its ⅛-in. layer produces best results. When welding is completed, the hammers are ground to the desired size and shape and reinstalled on the mill.

The road from stone pestles to hardened-steel hammers is a long one, but made infinitely easier by welding.

ULTRASONIC welder is being marketed by Sonobond Corp., Aeroprojects Inc. subsidiary.

Ultrasonic production welder introduced

SIMILAR AND DISSIMILAR metals and very thin gages of materials which defy conventional welding methods can be joined without fusion if welded by ultrasonics. So says Aeroprojects Inc., W. Chester, Pa., developers of the 2,000-watt Sonoweld ultrasonic welder.

Ultrasonic welding is a solid state joining process in which the materials to be welded are subjected to high frequency alternating vibrations generated by a transducer and transmitted through coupling members to the work.

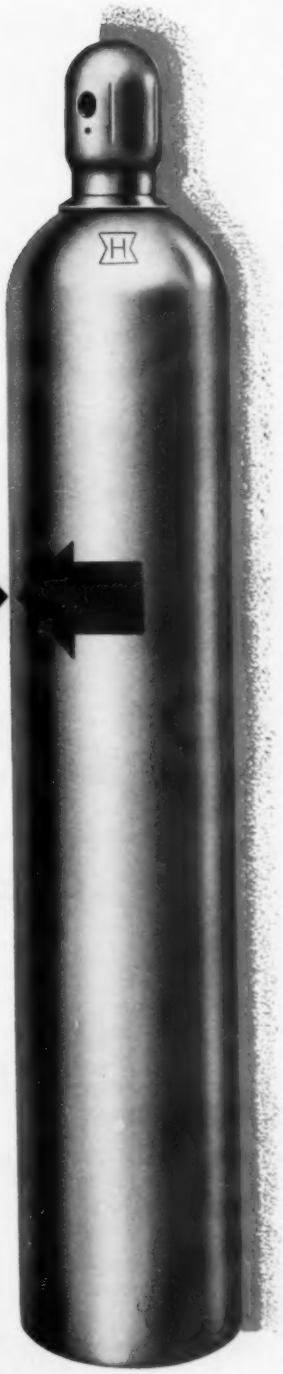
Difficult-to-weld materials that have been ultrasonically bonded, both to themselves and to other metals, include copper, nickel, molybdenum, tantalum, niobium, thicknesses of 0.050-in. 1100-H-aluminum and 0.025-in. 316 stainless steel.

Sonoweld is a semiportable spot welder requiring less electrical power than resistance welding. It can operate on a 230 volt circuit, consuming a maximum power of 3.5 kva.

Simple to operate, one places the work pieces between welding members and presses a foot switch which automatically starts the weld cycle.

The machine produces strong welds, fast, with little or no metal cleaning. Comparison of ultrasonic and resistance welds on 1100-H-14 aluminum to military specifications for resistance welds showed the tensile-shear strength of the ultrasonic welds averaged (1) 40% greater than minimum requirements for 0.050-in. thickness; (2) 200% greater for 0.010-in. thickness. Welding time was ¾ seconds.

HOW THICK SHOULD A CYLINDER BE



One of the most vital requirements in High Pressure Gas Cylinders is the assurance of adequate metal thickness to insure safety, as well as prolonged service life. To determine this, the XactRAY wall thickness gauge was developed by Harrisburg Steel Co. Exceeding the requirements for impartial testing of each cylinder as specified by the Interstate Commerce Commission, Harrisburg Steel Co. also employs such special quality control devices as the Sonigage and Vidigage. With the help of this equipment and by constant rigid inspection, cylinder users are assured of the safest and longest lasting containers whether made from manganese steel or chrome molybdenum alloy steel.

More than a Century in Harrisburg 24, Pa.

H HARRISBURG STEEL CO.

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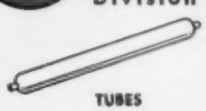

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RW-35

How much can be saved by fixing tractor parts, instead of buying new ones?

Welding saves farmers 70%!

MORE THAN 70% savings on the cost of new parts result from the use of automatic submerged-arc welding to rebuild tractor tracks, rollers and idlers. This is the opinion of Martin Tractor Co., Topeka, Kan., which uses this method to the farmer's advantage.

A brief example cited by Martin shows how welding, though not putting money into the farmer's pocket, can help leave it there.

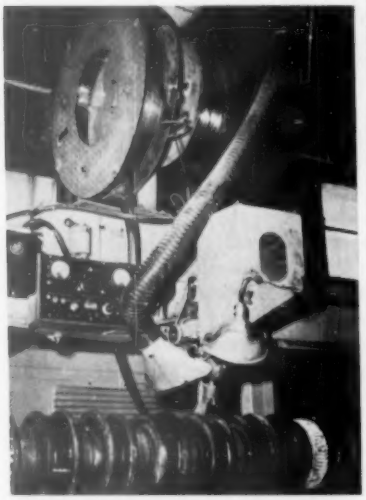
A complete set of new tracks, idlers and rollers for a Caterpillar D-7 tractor costs $1,346. But it costs only $376 to rebuild and finish the same parts, using submerged-arc welding. This is a savings of 72%.

Depending on the condition of the parts, they can often be rebuilt several times. This continuing maintenance can save farmers many thousands of dollars they would otherwise spend on new replacement parts.

In track and roller repair, the submerged-arc heads are mounted on side-beam carriages moving above the stationary workpiece. In the idler operation, the welding equipment remains stationary above the moving idler.

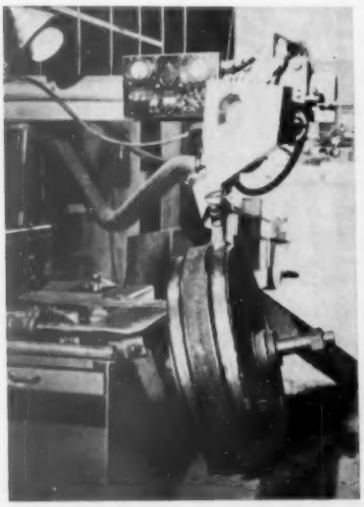
TRACTOR track is rebuilt with submerged-arc welding in one to three passes, depending on how badly parts are worn. Wire 3/16 in. in diameter is used.

Rebuilding rollers requires the most unusual application. Martin Tractor mounts as many as 12 rollers on one shaft. As the shaft rotates, the submerged-arc head is moved from roller to roller—saving time that would otherwise be spent in setting up individual parts.



TWELVE rollers, mounted on one shaft, are rebuilt by a submerged-arc head mounted on a side-beam carriage. Special cup holds flux on weld area.

Parts are rebuilt at a speed of approximately 15 in. per minute with an average current of 500 amp, a-c high frequency. Welding wire used is 3/16 in. in diameter. Linde Co. equipment is used in these operations.



TRACTOR idler revolves under submerged-arc welding head during rebuilding operation. No finishing is necessary. The lost part is replaced at 70% savings.

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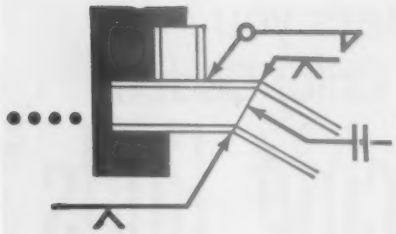


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Dangers of carbon tetrachloride

Question:

My firm must frequently clean gasoline tanks. To do the job, we usually use carbon tetrachloride. I feel this is a risky proposition but have nothing to back up my contention. Would you therefore answer these questions? (a) What harm can carbon tetrachloride work on an individual? (b) What percentage is needed to hurt a worker? (c) Is there another cleaner that has the same qualities which could be used without danger?

Answer:

You are certainly correct! Carbon tetrachloride *is* a danger, not a minor one either. In fact, many doctors state carbon tetrachloride is *four* times as dangerous as carbon monoxide.

So toxic are its vapors that one overexposure can injure, even kill, a worker. Smaller concentrations are nearly as harmful, if the weldor is exposed to them repeatedly.

How much of the gas a man can absorb and not be harmed is, however, still a matter of conjecture. But it is conjecture only inasmuch that authorities differ in accepting a minimum value. California, for example, says in an 8-hour day a worker can safely absorb only 50 parts of carbon tetrachloride to 1,000,000 parts of air (approximately the vapor from one teaspoonful in a room 10-ft long, 10-ft wide and 10-ft high). On the other hand, the Conference of Government Industrial Hygienists argues this is too much and should be cut in half.

If your firm insists on using the fluid—and we recommend they do not—we have several cautionary suggestions and, knowing the dangers, some antidotes.

First, make sure containers are tightly capped at all times, except when in use; second, work only in well-ventilated areas, preferably out-of-doors; third, do not drink alcoholic beverages immediately after working with the liquid. You need not, however, worry about fire hazards as carbon tetrachloride is nonflammable.

Call a doctor if a fellow worker shows any of these signs of poisoning: headaches, nausea, vomiting, stupor, shortness of breath, or loss of the sense of feeling. Should the liquid be accidentally swallowed, administer two to four glasses of corn syrup, (white is best) mixed with twice as much water. Call a doctor.

So much for carbon tetrachloride. You requested another solvent that has the same qualities. Here is a way of cleaning gasoline or oil tanks, which uses a hot chemical solution. Chemicals may be compounds of sodium silicate or trisodium phosphate (strong washing powder) dissolved in water.

Close all tank openings except drain and filling connections or vent. Fill the container to overflowing with water, preferably introducing the water through the drain. If there is no drain, flush the container by inserting the hose through the filling connection or vent.

Lead the hose to the bottom of the container to get agitation arising from the bottom. This will force any remaining gasoline, scum or sludge upward and out. Now drain the tank.

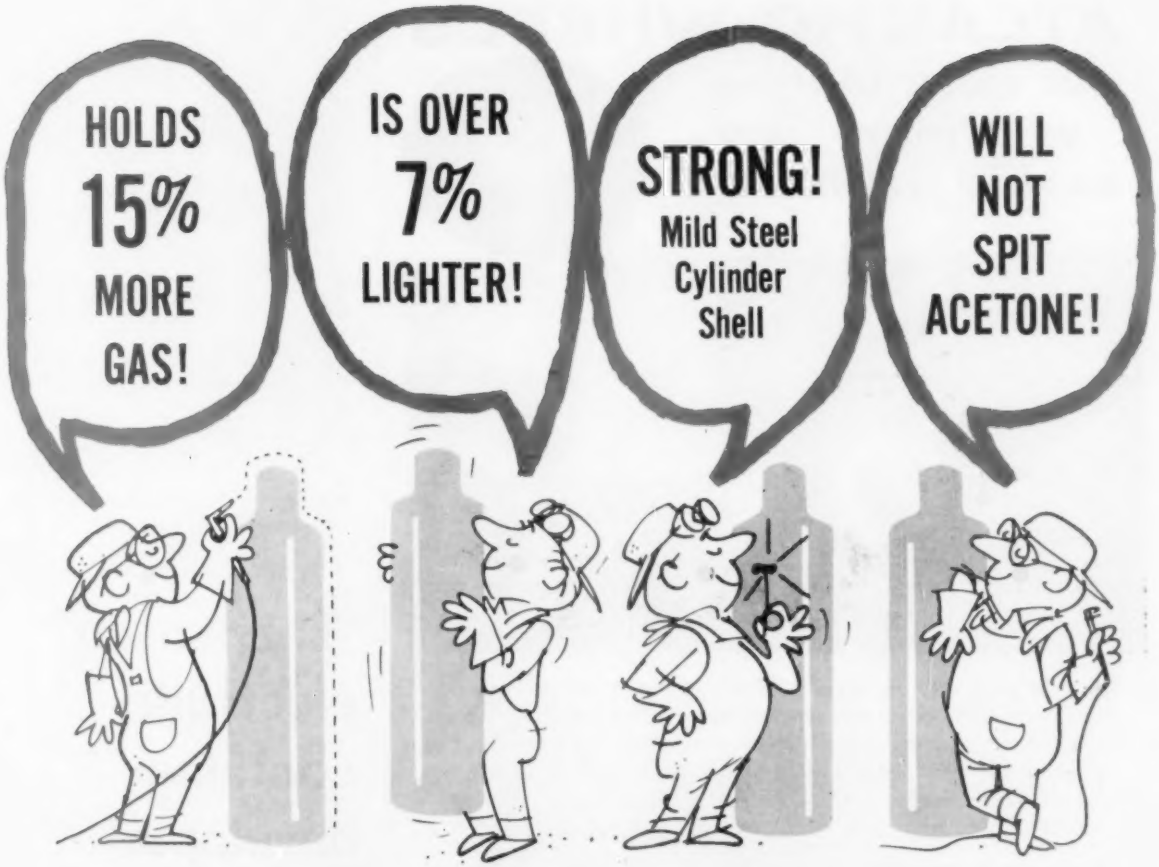
Dissolve the amount of chemical needed in boiling water. Use from two to four ounces of chemical per gallon of water. Pour the solution into the container and fill it with water.

Connect a steam line to the bottom drain of the tank. Using the steam, maintain the solution at 170 F to 190 F for 15 to 20 minutes. At intervals during the process, add enough water to cause overflow, thus discharging any volatile liquid, scum or sludge collected. Continue this until no appreciable amount appears at the top of the tank.

Drain the container and inspect it with a mirror and a flashlight (approved for use near flammable vapors). *Do not use a match.* If the tank looks clean, you're ready for the next step, if it doesn't, repeat steaming.

Close all openings for 15 minutes. Then reopen the tank and test the amount of gas present with either a combustible gas indicator or the Larmer gas sampler apparatus. If the sample taken from the tank is below the lower limit of flammability, your troubles are over. If not, continue cleaning until it is.

After cleaning, additional protection can be given during welding or cutting operations by two methods. One requires the tank be filled with water to within a few inches of the welding job. Make sure a vent is left open to allow heated air to escape. The other method is to fill the tank with inert gas. This may be either nitrogen or carbon dioxide. Nitrogen is available in cylinders as is CO_2. The latter gas may also be obtained by using cakes of dry ice.



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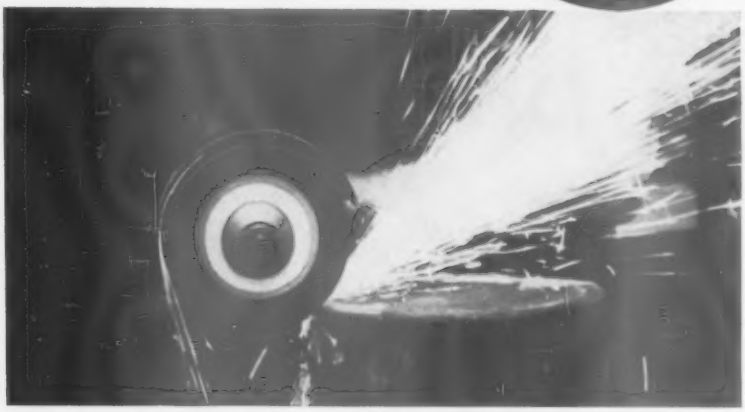

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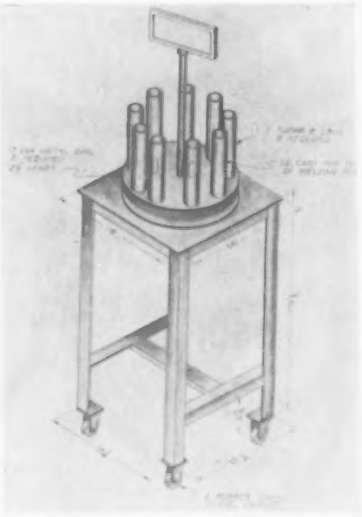


PORTABLE electrode container with revolving, detachable top.

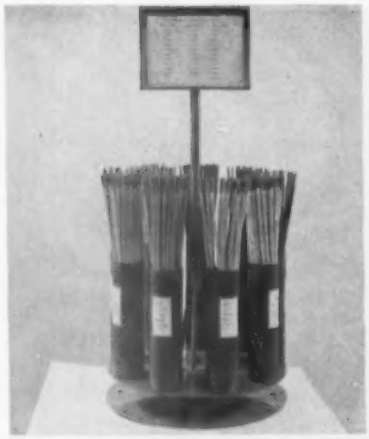
"Lazy susan" electrode container developed

by **L. E. Wagner**
Assistant Professor
Mechanical Engineering
University of Michigan

WHILE TRAINING STUDENTS in welding, I am asked many questions. Some of these queries reveal a deep interest in welding, some of them are just plain frivolous.

One set of questions recurred each semester, yet they appeared to be ones I could answer permanently: "What is the current setting for this?" "How can we keep all the electrodes we need without stumbling over them?" And, often muttered under a student's breath, "Where are those blasted E6010's?"

I, too, had questions. How could I keep all electrodes in one place, how could I keep tabs on what was being used and in what quantity, how could I give my students all the information they needed about a particular electrode, and how could I



CLOSER view of container's top.

avoid contamination to rods that had to be exposed to the atmosphere day after day?

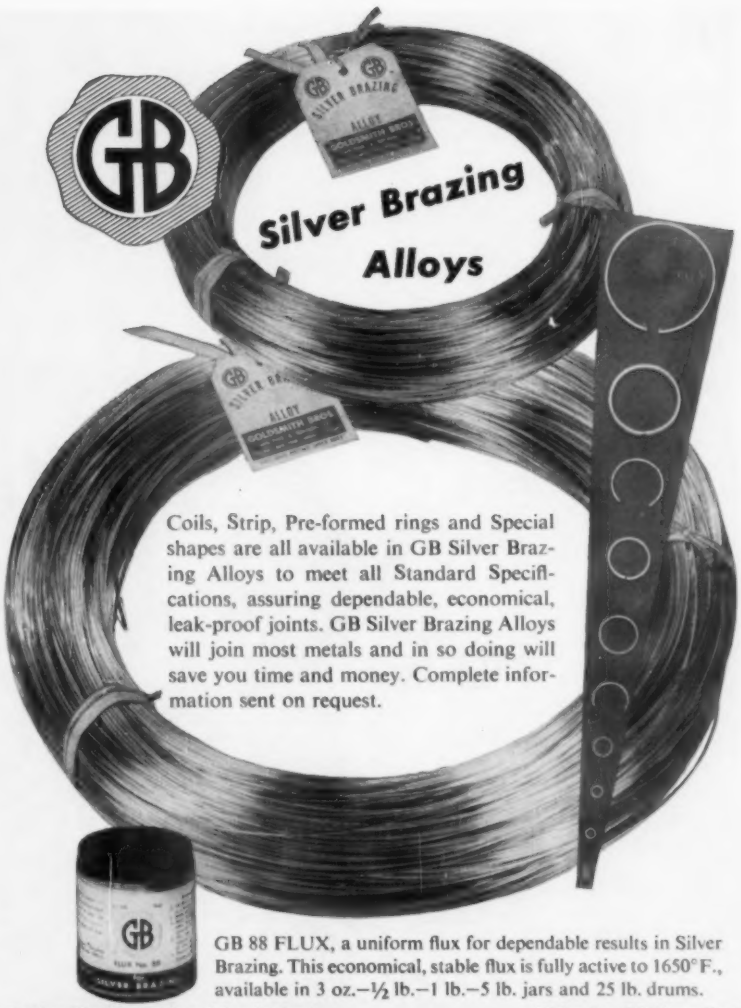
Finally, I sat down and designed a portable, revolving electrode container that answered all these questions to my satisfaction.

Being portable, the outfit can be moved easily from one area to another as the need arises. After the job is completed, or at the end of the day, it can then be rolled back to the storage room. All electrodes are in one place, making it simple for the student (or shop weldor) to choose the one he needs and easing my job (or the welding supervisor's) of accounting for electrode consumption.

An additional feature is the revolving, detachable top, a kind of "lazy susan." This can be removed from the table and placed conveniently near the worker. It also gives him easy access to as many different electrodes as he may need. The tubes serve a double purpose: not only do they hold electrodes but also they act as revolving bulletin boards on which can be posted the electrode's size, type, polarity, and recommended current settings.

The unit itself can easily be fabricated by following the design accompanying this article. If, however, a shop does not wish to enter into complete fabrication, a little ingenuity will supply a similar setup. The table, for example, can be a typewriter stand. Instead of tubing, original electrode containers might be used for the purpose.

We at the University have found the container very helpful. I hope industry will find it as useful.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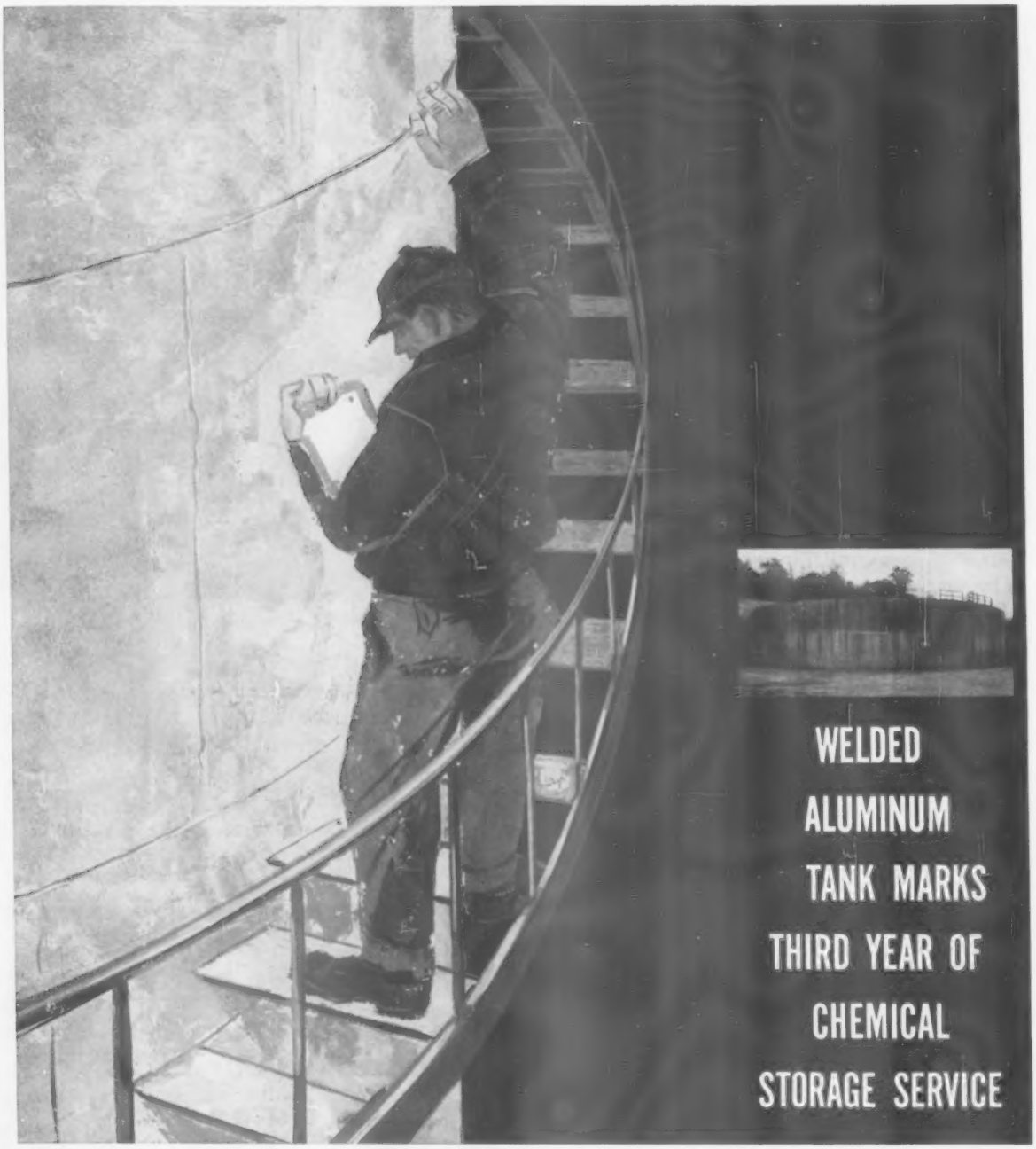

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The giant tank was field erected by the Chicago Bridge and Iron Company. Welds were made with Alcoa welding alloy 5052 by the inert-gas, metal arc-welding process. The bottom plates are 1⅞ inches thick and courses taper to ⅜ inch at the top.

Alcoa, besides supplying the aluminum for this gigantic undertaking, rendered valuable help and guidance before and during construction. You can get the same help in welding, brazing or soldering aluminum by calling one of the Alcoa Distributors listed here. For FREE informative books and for free loan of films on joining aluminum, write: Aluminum Company of America, 1740-L Alcoa Building, Pittsburgh 19, Pa.

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Cincinnati
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Cleveland
Nottingham Steel & Aluminum Div.
Williams and Co., Inc.
Columbus
Williams and Co., Inc.
Toledo
Williams and Co., Inc.

OKLAHOMA
Tulsa
Metal Goods Corp.

OREGON
Portland
Pacific Metal Co.
J. E. Haseltine & Co.

PENNSYLVANIA
Philadelphia
Edgcomb Steel Co.
Southern Oxygen Co.
Whitehead Metal Products Co., Inc.
Pittsburgh
Williams and Co., Inc.
York
Southern Oxygen Co.

TENNESSEE
Kingsport
Southern Oxygen Co.

TEXAS
Beaumont
Big Three Welding Equip. Co.
Corpus Christi
Big Three Welding Equip. Co.
Dallas
Metal Goods Corp.
Texas Welding Supply Co.
Houston
Metal Goods Corp.
Big Three Welding Equip. Co.
San Antonio
Big Three Welding Equip. Co.

UTAH
Salt Lake City
Pacific Metals Company, Ltd.

VIRGINIA
Norfolk
Southern Oxygen Co.
Richmond
Southern Oxygen Co.

WASHINGTON
Seattle
Pacific Metal Co.
J. E. Haseltine & Co.
Spokane
J. E. Haseltine & Co.

WISCONSIN
Milwaukee
Machinery & Welder Corp.
Steel Sales Corp.

MAINTENANCE at sea very often means welding at sea. Here a cam dog is rejuvenated aboard ship.

S.O.S.—S.O.S.—for these ships that means welding gives . . .

Stand-Out Service

NECESSITY HAS LONG since taught sailors the wisdom of choosing maintenance tools which have wide utility. "General purpose," "do-all" and other such expressions might mean a part, a tool, or an alloy and flux which enables a ship to conserve valuable payload space, yet be prepared for the myriad emergencies arising at sea.

That's why the 24 ships of the Grace Line which harbor at the Port of New York all carry welding, brazing and soldering equipment. Thus, with a minimum of gear and supplies, a thousand situations can be kept under control.

A case in point is that of worn cam dogs in cargo winch handles.

Worn cam dogs pose a very real threat because the handle can slip out of position and start the winch. Fortunately for Grace Line vessels, however, ship's stores include what has been called "an ideal two-rod oxyacetylene welding kit": a BCuZn-6 brazing rod and a nickel-silver build-up rod, which were supplied by All-State Welding Alloys Co., Inc. These have a wide range of application: mild steel, hot- and cold-rolled steel, high-carbon steel, stainless, non-ferrous materials, etc.

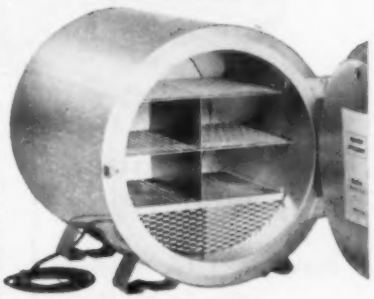
With this kit, it now costs only $0.92 to put a cam dog back in service whereas a replacement unit—were it available at sea—would cost $80.

YOU GOTTA KEEP 'EM DRY!

Moisture "messes up" electrodes, too, cuts welding profits.

End costly reworks by drying rods in

DryRod®
OVEN



Mineral coated electrodes are *thirsty*. The instant you unpack them they start soaking up moisture . . . within 2 hours often as much as 13 times US allowable specifications. Moist rods cause porosity, under-bead cracking, rough welds, etc. Rod scrap runs high Production slows down. Reworks eat up profits.

Storing rods in DRY-ROD OVEN prevents such losses, insures faster, finer workmanship at less cost.

Write for new literature on latest rod-drying methods, "Dry Rod as Standard Welding Equipment."

PHOENIX PRODUCTS COMPANY
4727 N. 27th St. • Milwaukee 9, Wis.

CHECK... and DOUBLE-CHECK... Then you'll BUY
FEATURES that do more for you in FIBRE-METAL's...

SuperGrip™

☑ light
☑ COOL
☑ easy
TO USE!

NEW, rugged design features increase life of HOLDER and CABLE!

POWERFUL COMPRESSION with EXTRA BITE!

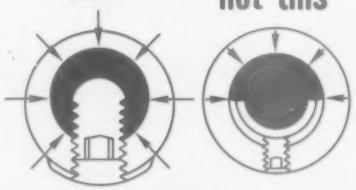
PERMANENT ALIGNMENT

FULLY INSULATED

HANDY, COMFORTABLE, LONG-WEARING

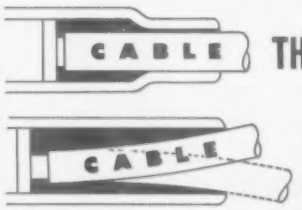
Full Surface Cable Contact for maximum conductivity!

THIS not this



POSITIVE SCREW POWER
Simple, Quick cable connect!

EXCLUSIVE Necked-down handle
No tape or bushing needed!

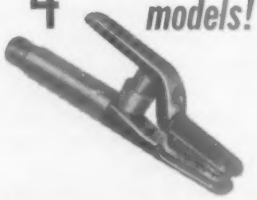


Snug fit—Necked-down handle reduces cable play–Less fatigue

SuperGrip Makes Welding Safer, Easier, More Economical!

Check, mate, and you'll *see* it's great! *SuperGrip* has the modern, effective design to produce more work easier, and to last longer for economy. It's continuously cool. It has every feature others have *and then some more!* The easy-to-assemble positive cable connection gives maximum current density and conductivity. The necked-down handle practically eliminates cable play and cable fatigue . . . for longer life and easier handling and welding. At every vital point . . . bushed pivot pin in the Aluminum Holder, long wear jaw surfaces, powerful spring, securely anchored cable, reduced cable play...*SuperGrip* approaches the ultimate in holder design. ***Ask your Welding Distributor for a SuperGrip TODAY!***

4 *SuperGrip models!*



Model "A-M"
300 Amps. (Aluminum) for ¼" Weld Rod

Model "C-M"
300 Amps. (Copper Alloy) for ¼" Weld Rod

Model "C-S"
250 Amps. (Copper Alloy) for 7/32" Weld Rod

Model "C-L"
500 Amps. (Copper Alloy) for ⅜" Weld Rod

Sold Everywhere thru leading Distributors and Dealers. *Ask for Bulletin 65*

THE FIBRE-METAL PRODUCTS COMPANY

TROUBLE-SHOOTING TIPS FOR BRAZING

IF BRAZING ALLOY DOESN'T WET SURFACES, BUT "BALLS UP" INSTEAD OF RUNNING INTO THE JOINT, TRY:

1. Increased amount of flux.
2. Roughened surfaces produced by shot blasting, pickling, etc.
3. Removing surfaces of cold-drawn and cold-rolled bar stock by machining or grinding.
4. Pickling parts to remove surface oxides.
5. Placing the assembly in a different position, such as on an incline, to encourage brazing alloy to run into joints.

Look for:

6. Impurities in the acid used for pickling, grit from shot blasting, lubricant from various machining operations, etc.

IF BRAZING ALLOY DOESN'T CREEP THROUGH THE JOINT, EVEN THOUGH IT MELTS AND FORMS A FILLET, TRY:

1. More time for heating.
2. Higher temperature.
3. A looser fit, or a tighter one.
4. Flux applied to both alloy and parent metals within and around joint.
5. More thorough cleaning of parts before assembly.

Look for:

1. Interruption of capillarity within the joint, such as by a gap.
2. Line contact within the joint instead of a uniform fit.
3. Freezing of brazing alloy caused by excessive pick-up of the parent metal.
4. Flux breakdown due to too much heat.
5. Improper or insufficient cleaning.

IF JOINT OPENS DURING BRAZING, ALTHOUGH IT WAS TIGHT WHEN ASSEMBLED, LOOK FOR:

1. Excessively tight press fit, which stretches outer member beyond its elastic limit.
2. High coefficient of expansion.
3. Unequal expansion of parts due to unlike metals or sections.
4. Release of residual stresses (stresses from cold-working) in certain parts.
5. An unsupported section which might sag at high temperatures.
6. Porosity in parent metals caused by burning through it when tack welding parts together.

IF BRAZING ALLOY MELTS, BUT RETAINS ITS ORIGINAL FORM WITHOUT FLOWING, TRY:

1. Coating the brazing alloy with flux before using and applying flux generously to parent metals within and around the joint.
2. Mechanically or chemically cleaning the brazing alloy, if **noticeably oxidized** before using.

IF BRAZING ALLOY FLOWS AWAY FROM, INSTEAD OF INTO, THE JOINT, TRY:

1. Providing a reservoir at the joint into which brazing alloy can flow.
2. Placing the assembly in a different position, such as on an incline, to encourage brazing alloy to run into joints.
3. Placing brazing alloy in a strategic position above the joint if axis is vertical, or against the shoulder if axis is horizontal, so it will creep into the joint.
4. A light copper plating on surfaces.

Look for:

5. Burrs at edges of punched holes, or other obstacles over which the brazing alloy might not creep.

(Information courtesy of United Wire & Supply Corp.)

MESSAGE #4

Welding Wire: Cost-saving

• Production men who are conscious of *both cost and quality* agree that a top-grade weld demands the *right* welding wire. *Only* by using wire with an analysis suited to the material to be welded can consistently sound welds—free from porosity and internal cracks—be produced. Use of the right wire means fewer rejects, less waste, lower costs—plus better performance of the finished part or product.

Experienced welding men have long found PAGE a most reliable source of welding wire for all their regular and special needs. The wide range of PAGE analyses—33 of them—makes it possible to select the exact wire that produces the kind of welds that lower production costs and increase profits.

PAGE experience, talents and facilities are available to you at all times. We have been exclusive wiremaking specialists for more than half a century, and are in an ideal position to furnish our customers with the right wire for each specific need. Furthermore, we have developed a broad packaging program which saves our customers time and money by supplying wire packaged to meet any requirement.

These factors, plus PAGE'S nationwide set-up of conveniently-located distributors, backed up by nearby PAGE warehouse stocks, help make it economical and profitable for you to standardize on PAGE Welding Wire.

PAGE offers—
33 ANALYSES
...the right analysis for your welding job

There are *33 different analyses* in the PAGE line, covering the broadest range of applications: submerged arc...inert gas...tungsten or metal arc...oxy-acetylene gas welding...metal spraying.

For example—

ANALYSIS A-S-6...This mild steel wire is used for welding mild steel where exceptional ductility is required. Its high elongation is obtained by holding the carbon (.06), manganese (.15) and silicon (.03) to the very low maximum given in parentheses.

Analysis A-S-6 is very close in physical properties to A-S-Armco. Used either with inert gas or a neutral flux, it will give clean non-porous welds averaging 50,000 p.s.i. tensile and 35% elongation with a Rockwell Hardness of B-65.

This same Analysis A-S-6 is also used for PAGE C Gas Welding Rods for oxy-acetylene welding, where it is the most generally used of all gas welding rods. PAGE C gas welding rods, used with a neutral flame, will give the same physicals as A-S-6.

For example—

ANALYSIS A-S-17...Analysis A-S-17 is a modification of the most popular submerged arc welding wire—PAGE A-S-10, which contains only a trace of silicon. In A-S-17, silicon is deliberately added up to .20% for use with inert gas.

The added silicon is a strong deoxidizer, scavenging the molten metal and giving a strong weld free from porosity, together with cutting down spatter and, through a more stable arc, giving deeper penetration.

All of this leads to higher physicals: up to 65,000 p.s.i. tensile and 30% elongation. It is recommended for CO_2 inert gas welding of low carbon steels, rather than A-S-10.

• • •

NOTE: previous advertisements in this publication have included brief descriptions of PAGE Analyses A-S-8620, A-S-6150, A-S-30, A-S-NAX-9115, A-S-65 and A-S-Armco Iron. Detailed information on all 33 PAGE analyses is contained in our **Welding Wire Comparison Chart DH-1218.**

Write for—Welding Wire **Comparison Chart DH-1218** (*shown above*). This highly informative four-page chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Also shows uses and physical properties, including: tensile strength, elongation, Rockwell hardness. Chart lists virtually all competitive makes.

Write for—Submerged arc and inert gas welding wire **Folder DH-402A**...also gas welding rod **Booklet DH-1277.**

This message is for men who are vitally concerned with such welding problems as maintaining a smooth flow of production... preventing excessive rejects...and insuring trouble-free, economical, profitable operation.

and Profit Factors

PAGE offers— Packaging to meet your needs

PAGE Welding Wires are packaged in a wide variety of ways—for the most complete protection and the utmost convenience in handling, in stocking and in use. Here are some major types of PAGE packaging:

1. Paper Wrapped Coils 2. Coils in Cartons, Palletized
3. Bare Coils (packed in Leverpaks)
4. Masonite Reels 5. Payoffpaks 6. Payoffpallets
7. Gas Rods in Burlap-wrapped Bundles
8. Stainless Gas Rods in 10-lb. Tubes

For example— PAYOFFPAKS

Up to 700 lbs. of wire, without a single weld...coiled around a fiberboard cylinder within a fiberboard drum ...ready to be smoothly unreeled to the welding head for automatic or semi-automatic welding! Eliminates costly machine down-time for coil replacement. Payoff-paks come in three sizes: 20" diameter (holds 250 or 500 lbs.); 23" diameter (holds up to 700 lbs.).

Wrapped Coils— Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want	Gas-shielded consumable electrodes		Filler wire for automatic or manual Inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire	
PAGE WIRE for ↓ / PACKAGING ↓	Automatic Welding	Semi-Automatic Welding			Manual Electric Welding	Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✔	✔	✔	✔		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✔	✔	✔	✔		
120 or 180 lb. (22"/24" I.D.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✔			✔		
Special coil sizes (on application).	✔	✔	✔	✔		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✔	✔	✔	✔		
Leverpaks, 15" dia., 25-lb. coils (12" I.D.x2½" wide); Leverpaks, 17" dia. 50/60-lb. coils (12" I.D.x4" wide).	✔	✔	✔	✔		
Payoffpaks: 20" dia. size holds up to 500 lbs.; 23" dia. size holds up to 700 lbs.	✔	✔		✔		
Payoffpallets, holding 900-1200 lbs. of wire (⅛" to ⅝" sizes, incl.) coiled around pedestal on a wooden pallet.				✔		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36" lengths.			✔			✔
Fibreboard cartons, containing 10 lbs. of rods in 36" lengths; single or boxed. 50s and over.			✔			✔
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14" and 18" lengths.			✔		✔	

Write for—PAGE Welding Wire Packaging Chart

This useful chart shows the many kinds of packaging of PAGE Welding Wires for each type of welding.

Now—about Delivery... PAGE offers— Availability from local stocks

• Here is a handy service that not only gets you the welding wire you need when you need it, but saves you money by making it unnecessary for you to tie up a sizeable investment in wire inventory.

You can get the exact PAGE automatic welding wire and welding rods your job requires direct from your nearby PAGE Distributor. Located at many points from coast to coast, PAGE distributors carry sizeable stocks for your convenience—and they are backed up by PAGE Warehouses at the strategic locations shown below. Close cooperation between PAGE distributors, PAGE warehouses and the PAGE mill is your guarantee of prompt, intelligent, individual service on your specific needs.

ACCO

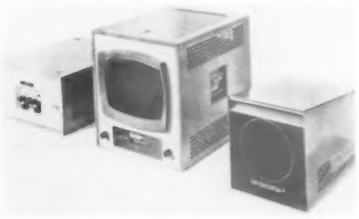
Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston* Los Angeles*, New York, Philadelphia*, Portland, Ore. San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

ACCO for Better Values

new products . . . . . USE CARD ON PAGE 95



X-ray system

TVX, an X-ray intensification process that permits economical 100% product inspection on a television screen 10,000 times brighter than a conventional fluoroscopic image, is comparable to closed-circuit television. Receivers can be set up at several points, if needed. It has three basic units —an X-ray sensitive camera, control unit and monitor. TVX requires 110/117/125 volts a-c, ± 10%, 60-cycle, single-phase, 530 watts. The camera takes 55 watts of input power, the control 305 watts and the monitor 170 watts. *General Electric Co.*

Circle No. 1

Fixture clamp

SAXTON 9F Kant-Twist fixture clamp is said to be so versatile for big jobs it was added to company's line after originally being designed for a specific job. *Saxton Mfg. Co., Inc.*

Circle No. 2

Track welder

DUAL-head automatic track welder includes electric template for fast setup, flux handling hoist operating full length of track and built-in automatic wire feed adjustment. Unit has a constant potential, 100% duty cycle power supply providing two 500-amp circuits for the dual welding heads. Unit speeds crawler track rebuilding, with a complete set of D8 tracks with ¼-in. worn depth taking one operator 14 hours, says manufacturer. *L&B Welding Equipment Inc.*

Circle No. 3

Brazing alloy

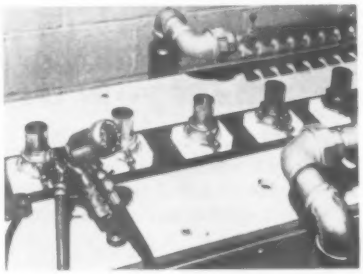
LITHIUM-containing silver brazing alloy, Fluxless Nu-Braze 0070, was designed to join such metals as precipitation hardening stainless steels and other aircraft steels designed for high temperature applications. Alloy has a melting range of 1,435 F solidus to 1,635 F liquidus. It contains 0.2% lithium, 92.5% silver and copper. Alloy is being used for joining structural parts intended to operate in 900 F. *American Silver Co.*

Circle No. 4

Furnace

KR-Super is a new electrically heated high temperature furnace (up to 3,100 F) that does not require protective furnace atmosphere. The manufacturer says that because of the long life, non-oxidizing, non-flaking oxide coating protected elements of the furnace, new processing possibilities on a large variety of metal, ceramic and chemical products are offered. *K. H. Huppert Co.*

Circle No. 5

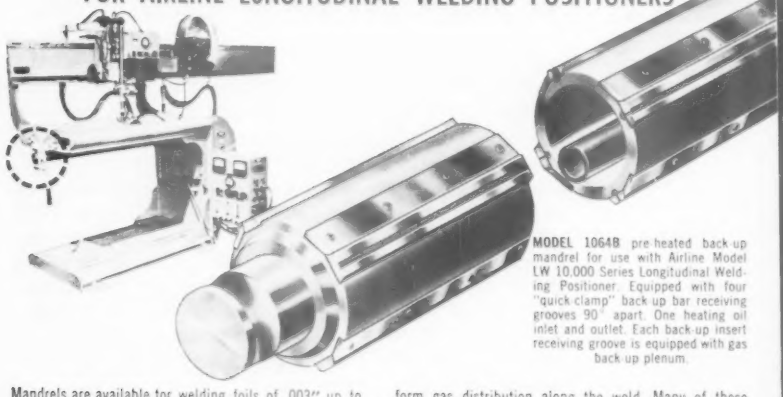


Silver brazing

NEW process is claimed to speed production silver brazing. Installation of facilities is inexpensive. Equipment pre-places the brazing alloy and flux onto the parts to be joined while they are on production line. Automatic heating devices complete the brazing operation. *Fusion Engineering.*

Circle No. 6

Airline FEATURES A BROAD VARIETY OF BACK-UP MANDRELS FOR AIRLINE LONGITUDINAL WELDING POSITIONERS



MODEL 1064B pre-heated back-up mandrel for use with Airline Model LW 10,000 Series Longitudinal Welding Positioner. Equipped with four "quick-clamp" back-up bar receiving grooves 90° apart. One heating oil inlet and outlet. Each back-up insert receiving groove is equipped with gas back-up plenum.

MODEL 1063B water cooled welding back-up mandrel commonly used for high production submerged arc and MIG welding applications. Equipped with two removable copper back-up inserts.

MODEL 1460A heavy duty welding back-up mandrel designed for welding large cones, cylindrical shaped objects and flat sheet.

MODEL 1060A heavy duty welding back-up mandrel equipped with one copper back-up insert. Designed for welding large diameter and long (up to 12' 0") heavy walled cylindrical objects.

MODEL 1662-4 thermostatically controlled pre-heated mandrel for use in welding medium alloy steels. Equipped with one removable copper insert and gas back-up plenum.

MODEL 1121A small diameter welding back-up mandrel equipped with one removable copper back-up insert and gas back-up plenum. For welding small diameter tubing.

Mandrels are available for welding foils of .003" up to sheet stock of .250". Mandrels are furnished for welding ferrous, non-ferrous, austenitic and ferritic metals. Various models are designed to facilitate positioning of tubular, flat or rectangular shapes and are rotatable and interchangeable. Copper, steel or stainless steel back-up bars are furnished with weld "drop-thru" grooves to control weld root bead, size and contour. Many models are furnished for inert gas backing, featuring a plenum gas reservoir. Inserts are provided with orifices for uniform gas distribution along the weld. Many of these models are designed for normal "chill-shunt" weld tooling principles while others employ thermostatically controlled heating or water cooling.

Stainless steel and steel back-up inserts are for use in welding non-ferrous materials such as aluminum and magnesium alloys. Copper back-up inserts are used for welding steel, stainless steel, titanium, tantalum, molybdenum, zirconium, beryllium-copper, etc.

Write for complete information on Airline Longitudinal Welding Positioners and accessory equipment.

All illustrated mandrels are interchangeable in all Airline Longitudinal Welding Positioners.

Airline WELDING AND ENGINEERING
760 NORTH PRAIRIE AVENUE, HAWTHORNE, CALIFORNIA
OSBORNE 5-4225 OSBORNE 5-3156 OREGON 8-5112

For 27 Years Preferred By Welders

THE DURO "STANDARD"

- All Parts quickly replaced with a screwdriver
- Screw-in type jaws — No tools required
- Insulated Handle and Guard — Protects operator
- Rugged Fibre Handle — Lasts longer
- Cool Operation — Cool Handling

Featuring "Long Jaw design" for reaching those "hard to get at places"

The New Duro "DUROGON" Tong-Type

THE DUROGON-N3 and N3HD

- All Parts quickly replaced with a screwdriver
- Fully Insulated — Greater safety
- Cool Operation — Cool Handling
- With ALUMINUM Body — Less operator fatigue
  Mechanical Cable Connection
- With BRONZE Body — For heavy duty operation
  Mechanical, soldered or brazed connection

"The BEST of this Popular Design!"

DURO

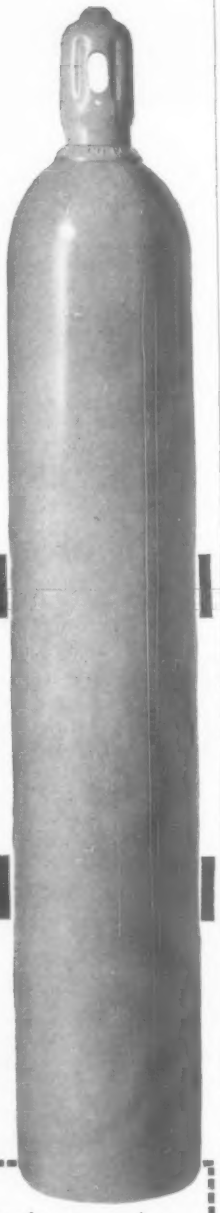
ENGINEERING COMPANY · 31 OREGON AVE. · HAMDEN, CONN.

Hackney
MILWAUKEE

streamlined high pressure gas cylinders* cut distributors' shipping costs

There was a time when backbreaking weight was a sign of safety in high pressure gas cylinders.

Then HACKNEY deep, cold drawn process eliminated costly excess weight without sacrificing *safety and durability.*



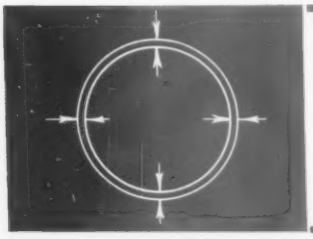
As a result, high pressure gas distributors are able to:

- save money on shipping charges
- reduce handling costs—minimum manpower needed
- cut maintenance costs—smooth surfaces easily cleaned and painted
- speed handling—more product per pound of steel
- make faster deliveries customers appreciate

More reasons for owning HACKNEY High Pressure Gas Cylinders

- Uniform cylinder capacity—simplifies filling.
- Surface free of crevices, ridges—always looks attractive.
- Light weight—easier to handle.

**Available in all shapes and sizes to meet your customers' requirements—from small medicals to 220's and 250's (cu. ft.) for oxygen, hydrogen, nitrogen, helium, argon and carbon dioxide.*



Uniform sidewall thickness—from top to bottom, side to side of cylinder. Shown: typical section of Hackney cold drawn cylinder showing uniform wall thickness.

For complete specifications of Hackney cylinders for high-pressure gases, prices and other helpful information, write to:

Pressed Steel Tank Company

Manufacturer of Hackney Products since 1902

1456 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Arc welder

NEW machine was designed to weld transmission shafts to carrier cases with a complete cycle time of only 12 seconds. The automated arc welder welds two dissimilar alloy pieces, which have been preground and finished to accurate dimensions, with no measurable change in tolerance, says manufacturer. Machine completes three steps automatically—preheating by high-frequency induction to 600 F, a 360 degree arc weld under a CO_2 gas shield, and unloading to cushioned conveyor rails. *Progressive Welder Sales Co.*

Circle No. 7

Steel protection

NICROCOAT process gives mild steel and other low cost metals oxidation, corrosion and abrasion protection. The special alloy coating is applied to the metal to be protected after fabrication. The alloy is bonded to the base metal by heating to a specified temperature under controlled conditions in a pure dry hydrogen atmosphere furnace. Thicknesses of 0.002 to 0.010 in. may be applied by spraying, dipping or brushing on to base metal. *Wall Colmony Corp.*

Circle No. 8

Blower heaters

LIGHT, compact heater units operate at 15 psi and assure an output of 120,000 BTUs per hour. Model 1700B has a 100% safety shutoff solenoid valve thermocouple selector and relay that shuts off gas if power or flame should fail. Model 1701B has the safety feature plus an automatic electric ignition that automatically starts the unit after a power failure. Heaters are approved by Underwriters' Laboratories. *Insto-Gas Corp.*

Circle No. 9

Grid circuit

THYRATRONS of all types and sizes are smoothly controlled by Thyra-Pulse, newly packaged grid circuit that eliminates circuit development when using thyratrons for industrial controllers. Control input can be a variable resistance or variable a-c/d-c voltage or current. Unit can be used in half- or full-wave and three phase circuits. Internal d-c with superimposed a-c bias eliminates line transient mis-firing, manufacturer says. *Hanson-Gorrill-Brian Inc.*

Circle No. 10

Power plants

RATED output of new gasoline engine driven welder power plant is 250 amp at 40 volts, 100% duty cycle. D-250 Roustabout has 2-IN-1 arrangement so that either of two d-c welding current ranges, 75-175 amp or 125-350 amp, and 1 kw of 115 volt d-c auxiliary power are available simultaneously. Machine produces 10 kw of 115/230 volt, single phase, 60 cycle a-c. *Miller Electric Mfg. Co.*

Circle No. 11

Our most popular Face Shield...

of a very popular line!

Aluminized . . . reflects over 80% of Radiant Heat

You'll keep your workers cooler, more comfortable, more efficient (as well as protected) with the AO H-3. Aluminizing also eliminates costly window replacement due to heat crazing and warping. TESTS INDICATE OVER 4 TIMES LONGER LIFE. American Optical "H" Series Face Shields feature quick window interchange, light weight and the model shown has a deeper spark deflector. Adjustable fiber headband — genuine leather sweatband. Aluminized Face Shields provide *quality* protection in furnace operations — smelting — forging — metal pouring — and heat operations requiring a face shield.

H-3 W84AL
FACE SHIELD

AO 9706W

For more "Cool Comfort" and Efficiency ...AO Weld-Cool Welding Helmet

(Reflects 70% of Radiant Heat)

Approximately 50% cooler inside — and that's good news to any welder! Cooler in the eye area also because of AO's 168AL aluminized plastic coverplate. "Radio dial" turning adjusts to proper head size. Helmet interior is black to prevent any chance of diffusing light rays. Helmet is particularly recommended for gas shielded arc welding. Non-warping, moisture-proof fiber glass construction also makes helmet ideal for outdoor welding. Other Features: Flame resistant, stationary or lift front aluminum glass holder, vulcanized fiber chin rest. Your nearest American Optical Safety Products Representative can supply you.

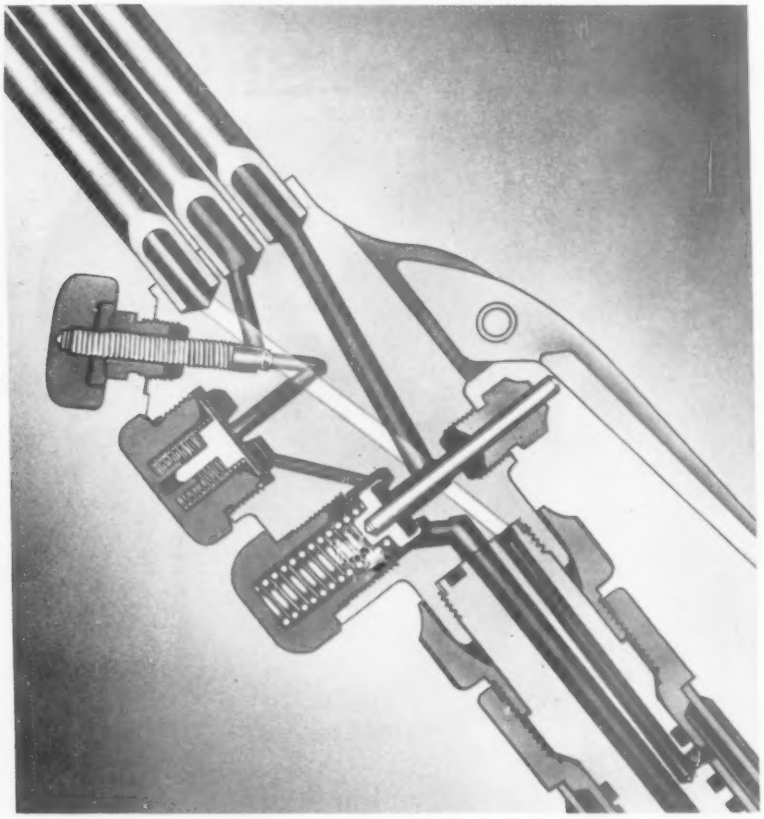
NOTE: AO Sweatbands are *another* aid to safety, comfort, productivity — and cost *little*. Check your stock.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASS.

Always insist on Trademarked Safety Products

Safety Service Centers in Principal Cities

1833-1958 • 125 LEADERSHIP YEARS



This spring-loaded, diaphragm-type, back pressure check valve greatly reduces the number and effect of backfires. Developed and patented by Smith's, "Flo-Trol" prevents the back flow of oxy-acetylene mixtures. It's exclusive, standard on all Smith's cutting assemblies.

BONUS . . . the World's Best Repair Service when you use Smith's equipment!

Users' experience has shown that the safety features such as Flo-Trol valves developed in our welding and cutting equipment mean fewer repairs as well as safer working conditions. This low frequency of repairs is the reason we can afford to back our products with the World's Best Repair Service.

Here's how it works: when a piece of your Smith's equipment becomes inoperative, you exchange it for a 100% factory reconditioned piece of the same equipment . . . completely overhauled, with new seats, packing, seal rings, and newly refinished in bright nickel. No matter what the damage to your equipment, your only cost is a low flat-rate repair charge. *And there's no waiting:* you make an on-the-spot exchange at your Smith's distributor. Just bring in your damaged equipment, pick up a like-NEW replacement!

For more information about the World's Best Repair Service covering all major items currently manufactured, *write:*

SMITH'S

Smith Welding Equipment Corporation
2623 Fourth Street S.E., Minneapolis 14, Minn.

Portable spot welder

REX full-sized portable spot welder Models RP-10 and RP-20 are water-cooled and cart-mounted for mobility and are available with 10 or 20 kva. Both models have built-in electronic timers and magnetic contactors that are said to insure high-quality consistent welds. Pinch gun is standard, but push gun can be supplied. The small unit will weld two pieces of mild steel to 1/8-in. combined thickness, the large unit to 3/16-in. combined thickness. *Peer Inc.*

Circle No. 12

Safety goggles

CUP-TYPE safety goggles have high impact resistance with contour design that guarantees safety and a comfortable fit. Weldor's goggles have Arc-Ban, a dark green glass which completely protects one from infrared and ultraviolet rays. Arc-Ban is available in 10 shades, each allowing proper protection for various types of welding. *Bausch & Lomb Optical Co.*

Circle No. 13

Ammeter

AMPROBE Deca-Tran, designed for use with any Amprobe where an extension of ranges is needed, is said to multiply an Amprobe's versatility by 10. Readings can be taken on round conductors as large as 2 1/16 in. in diameter, and bus bars as large as 3/4 by 2 1/2 in. *Pyramid Instrument Corp.*

Circle No. 14

Couplers

KAMLOCK couplers are used for hoses, pipes and equipment when a quick couple is needed. Couples are available in 1/2 to 3-in. sizes, and are suitable for pressures to 200 psi and temperatures to 550 F. *Jordan Industrial Sales Div.*

Circle No. 15

"Baltospot is lightweight—the only completely portable 140-kv unit on the market. Ideal for inaccessible places."

E. E. Ellis says, "There's nothing to it. This unit will radiograph steel up to 1¾ inches thick."

"In less than a day I could teach anyone to make good inspection X-rays with BALTOSPOT,"

E. E. Ellis

J. B. Fisher

says E. E. Ellis, Welding Engineer and Radiographer, Fisher Tank Company, Chester, Pennsylvania. "One year of experience with Baltospot X-ray equipment proved to us that practically anyone can make good radiographs. There are just three simple steps:

1. measure thickness of part and refer to chart
2. make exposure
3. develop film according to chart

X-ray inspection keeps us on our toes and is far ahead of other methods."

Does Baltospot Pay?

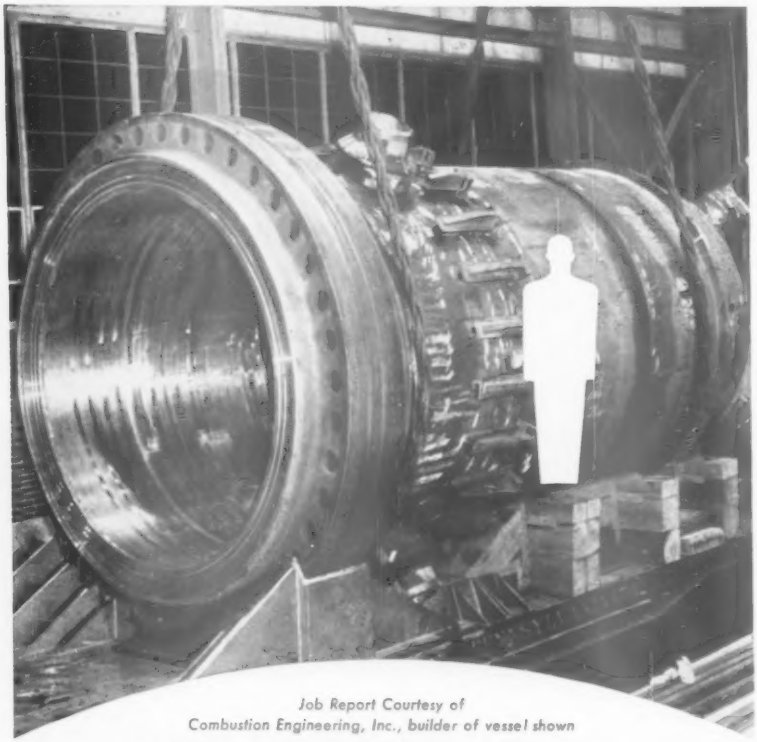
"It certainly does," says J. B. Fisher, President, Fisher Tank Company. "We exercise better control over all phases of work, and save approximately 77 percent in radiography costs. Helping our welders maintain uniform high quality and developing new welding techniques are prime functions of this, the most effective means of testing welds."

Your Westinghouse X-ray Specialist has information on the full line of industrial radiographic-fluoroscopic equipment, or write: Westinghouse X-ray Department, 2519 Wilkens Avenue, Baltimore 3, Maryland. J-08369

YOU CAN BE SURE...IF IT'S

Westinghouse

This WELDED nuclear pressure vessel holds a practical idea for you

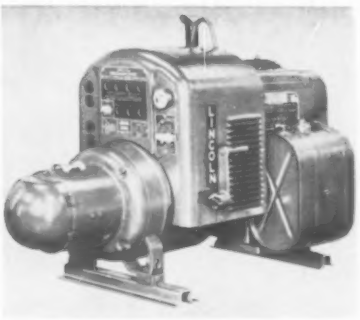


Job Report Courtesy of
Combustion Engineering, Inc., builder of vessel shown

USE ARCOSITE FLUX

for submerged arc welding

In nuclear installations where radio activity makes weld failure dangerous to personnel and can cause indefinite shutdown, sound corrosion resistant welds are of utmost importance. To inhibit corrosion, portions of the 9 ft. dia. interior of this 33 ft. reactor were overlaid with ¼ in. of 308L weld metal. Submerged arc welding with ARCOSITE S4 flux was used for the job. The girth and longitudinal joints of the low alloy steel plates were also submerged arc welded using ARCOSITE 85 flux. Cost-wise, no other conventional method of cladding was practical. Arcos weld metal quality guarantees corrosion resistance . . . freedom from maintenance. ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.



Combination welder

WELDANPOWER is a combination 200 amp a-c arc welder and 5 kva power supply designed for use by contractors, farmers and industrial maintenance departments. The welder is air-cooled, has a 4-cycle model TFD engine and delivers 13.1 horsepower at 2,000 rpm. The combination also provides 115 to 230 volt, 60 cycle single phase power. The welder handles 5/64-in. through 3/16-in. electrodes. *The Lincoln Electric Co.*

Circle No. 16

Respirator

THERMALAIR is a respirator that gives protection against excessive heat, such as that in kilns and ovens where temperatures reach 150 F to 300 F. Device exchanges overheated air for respirable air when wearer inhales. When worn with proper asbestos clothing, Thermalair sometimes gives wearer more freedom of movement because it substitutes for self-contained breathing apparatus. *American Optical Co.*

Circle No. 17

Control valves

SERIES of high-flow capacity poppet-type control valves is designed for remote pilot operation on large, high-speed brakes, clutches, etc. The new 2-and 3-way valves are said to provide instantaneous response because of short poppet travel. Valves have three stainless steel moving parts, and bronze bodies. Sizes from ⅜ through 1½ in. *Valvair Corp.*

Circle No. 18

Bronze rod

A flux coated bronze welding and brazing rod for oxyacetylene welding and brazing has proven to be ideal for bronze and fusion welding and for surface build-up, says manufacturer. Rod is made of degasified, deoxidized, low fuming bronze specially coated so rod does not have to be dipped in flux can. *Aufhauser Bros.*

Circle No. 19

Sintering furnace

MODEL 2915 is an automatic high vacuum, high temperature sintering furnace. It has a 6-in. diameter by 10-in. high hot zone at pressures down to 10^{-6} mm. Hg. and temperatures up to 2,400 C. The unit is equipped with safety interlocks to prevent accidental work spoilage. *NRC Equipment Corp.*

Circle No. 20

Reflectoscope

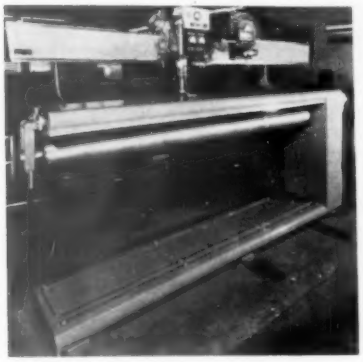
MODEL UR-600 is an ultrasonic inspection instrument that locates surface and internal defects in materials and determines differences in structure and physical properties. Test frequencies are 0.4, 1.0, 2.25, 5.0 and 10.0 megacycles. Power requirements are 110 or 220 volt a-c, 50/60 cycles, 190 watts, single phase. Includes cables, search units, reference blocks and other equipment. *Sperry Products Inc.*

Circle No. 21

Acetylene cylinder

NEW acetylene cylinder has a modified lime silica filler that is said to increase gas capacity by 15% while reducing weight by 7%. Manufacturer says cylinder takes a fast charge, yet there is no loss of acetone, even if gas is discharging at high rates. Cylinders are available with 10 to 350 cu ft capacities. *Norris-Thermador Corp.*

Circle No. 22



Welding positioner

MODEL LW10020 is a medium hold-down pressure longitudinal welding positioner for joining metals to ¼-in. thick in any regular configuration from flat sheet to cones or cylinders up to 30 in. OD. Positioner has several interchangeable mandrels that can be heated up to 400 F. It has a 10-ft welding length with 30-in. total working space height. Includes semiautomatic Tig welding apparatus. Welder permits use of automatic voltage controlled welding head with thoriated magnesium and aluminum alloys. *Airline Welding & Engineering.*

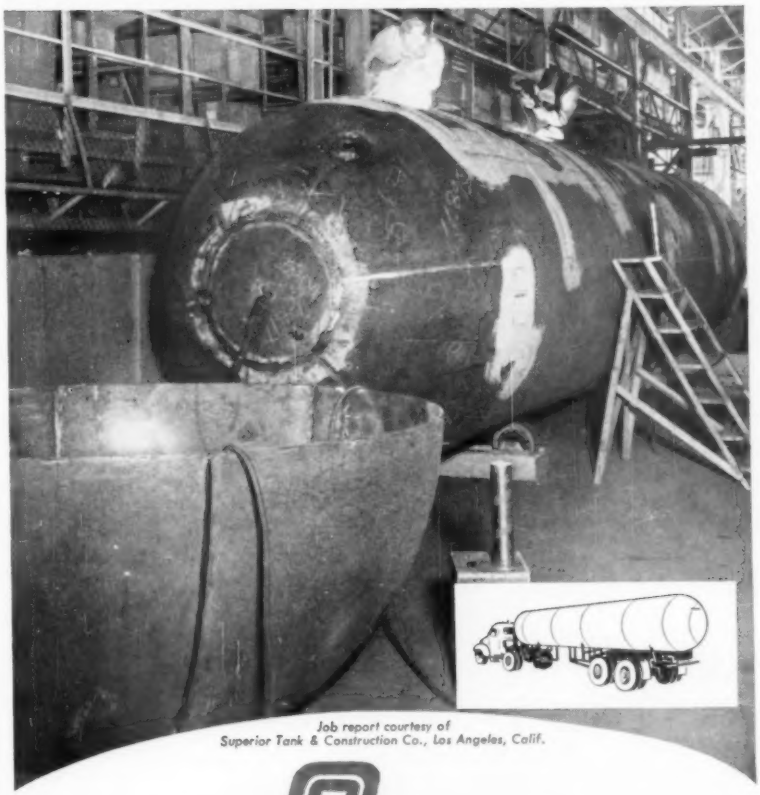
Circle No. 23

All-purpose clamp

WMF all-purpose clamp with its 0 to 3¾-in. and 0 to 1¼-in. extent of jaws, and standard 1½-in. throat depth, can be used with standard clock gage for inspection of small parts. Quickly positioned unit is particularly adaptable to needs of the toolmaker because it eliminates the normal time-consuming chore of adjusting screws. Jaws do not mark ferrous or non-ferrous materials. *Research Engineering and Sales Co.*

Circle No. 24

How X-Ray Quality Welds Make Low Alloy Steels Pay Off



Job report courtesy of
Superior Tank & Construction Co., Los Angeles, Calif.

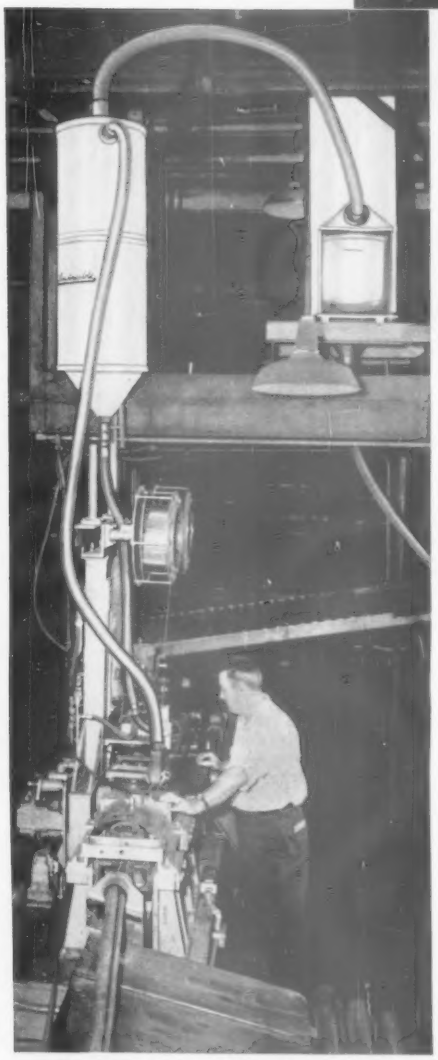
WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

The vessel being welded is part of an L.P.G. tank truck. For high strength with low weight—USS "T-1" steel is used and welded with Arcos Ductilend 110 Electrodes. These tanks meet or exceed ASME code requirements . . . and all Ductilend 110 welds qualify with X-ray soundness. Ductilend 110 is an Arcos Low Hydrogen Electrode especially developed for welding high strength notch tough steels of the 110,000 psi tensile strength range. Data sheet on request. ARCOS CORPORATION • 1500 South 50th Street, Philadelphia 43, Pa.

Savings in reclaimed flux alone have paid for Invincible units in a few months, or even weeks, on submerged arc welding jobs.

INVINCIBLE
Welding Flux Recovery Systems
MAKE 3-WAY SAVINGS



Operating continuously, this Invincible recovers all unfused flux from pipe-seam welding operation at a leading automotive firm.

1 *Valuable Flux Reclaimed. Automatic* Invincibles recover *all* unfused flux and return slag-free, dust-free usable flux to the welder — *all in one continuous operation.*

2 *Costly Man-Hours Saved.* Invincibles do the complete job automatically — far more swiftly and efficiently than manual methods.

3 *Fewer Expensive Rejects.* Invincibles remove all fine dust (flux flour), thus reducing welding rejects and speeding production.

Many Important Advantages

- Ruggedly built to resist abrasive nature of flux.
- Compact and lightweight. Variety of models and flexibility eliminate need for tailor-made installations.
- Portable units also available.

WRITE TODAY FOR FOLDER on Invincible Flux Recovery Systems.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

Welding machine

AIRCO MSM Busybee is a low-cost, 180-amp, portable a-c transformer designed for general repair work in garages, filling stations, hobby shops and farms. Glass-insulated copper magnet wire is used in primary and secondary coils. Busybee has continuous current control within each range which is accomplished by operating a crank on the front panel. Open circuit voltage is 55 to 80 amp. Machine will take electrodes to and including 3/16 in. in diameter. *Air Reduction Co., Inc.*

Circle No. 25

Tangent benders

NEW tangent bender offers fast, accurate method of working with lighter metals, says manufacturer. It was designed to fill a need for smaller type machine to do tangent bending on product sizes that do not require heavy hydraulic machines. Machine is made for small products less than 6 in. wide. Requires no front clamping mechanism and has rapid operation cycle. *Taylor-Winfield Corp.*

Circle No. 26

Sample kit

IDEA kit contains samples of extruded aluminum shapes. The kit is intended to suggest ideas to the product designer for short-cuts in production or other phases of his job. Three dimension thinking is available when kit is used and samples are pieced together. *Midwest Aluminum Corp.*

Circle No. 27

Fluxless soldering

NEW production technique allows aneroid elements of barometers, altimeters, depth gages and other pressure-sensitive devices to be soldered without flux. Another new process eliminates manual soldering. Both processes are accomplished by flash coating mating surfaces with tin or similar substance and then soldering or heating in a controlled atmosphere oven. *Dalic Metachemical Ltd.*

Circle No. 28

For only $99 — you're "in business" with this PUROX W-200 Starter Set

You get all this standard, professional equipment:

- Welding Blowpipe
- Welding Head (welds up to ⅛")*
- Cutting Attachment (90° head)
- Cutting Nozzle (cuts up to 2")
- PREST-O-LITE Oxygen Regulator
- PREST-O-LITE Acetylene Regulator
- 12½-ft. Fitted Double Hose Assembly
- OXWELD Goggles with "A-A" Lenses
- OXWELD Friction Lighter
- Blowpipe Wrench
- Regulator Wrench
- Complete Setup and Operating Instructions
- Enameled *Steel* Carrying Case for everything

and—for a limited time only, at no extra cost—

How-To-Do-It Reference Library of 17 instructive booklets (total list price, $3.35). (Offer good during October, November, and December, 1958 only.)

*9 additional head sizes available, as required, for welding all metal thicknesses up to ½ inch

COMPLETE $99.00

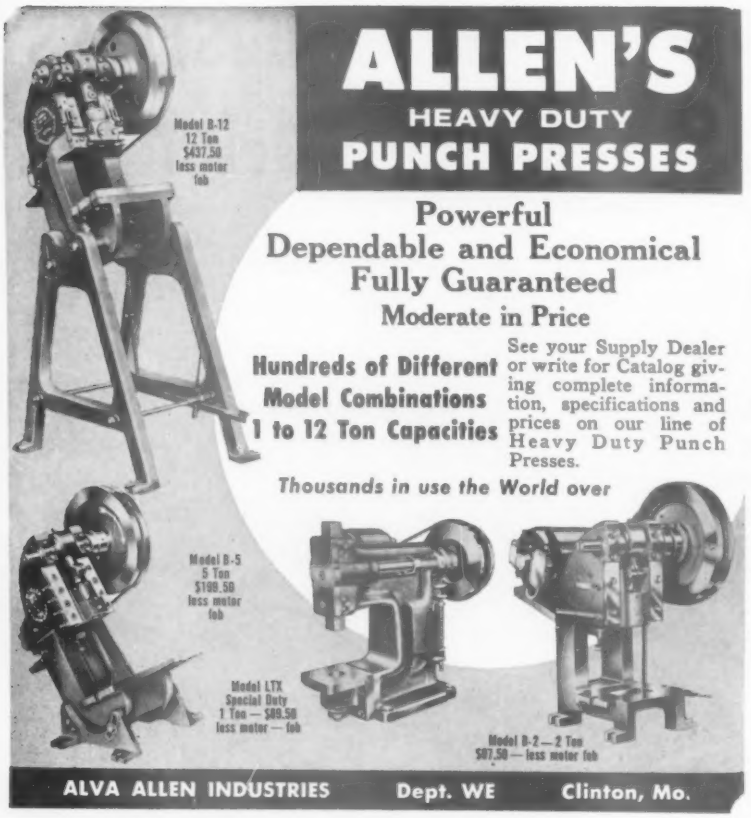
This is a LINDE-built, high-quality welding and cutting outfit, designed for rugged service. All standard industrial equipment for maximum flexibility and portability.

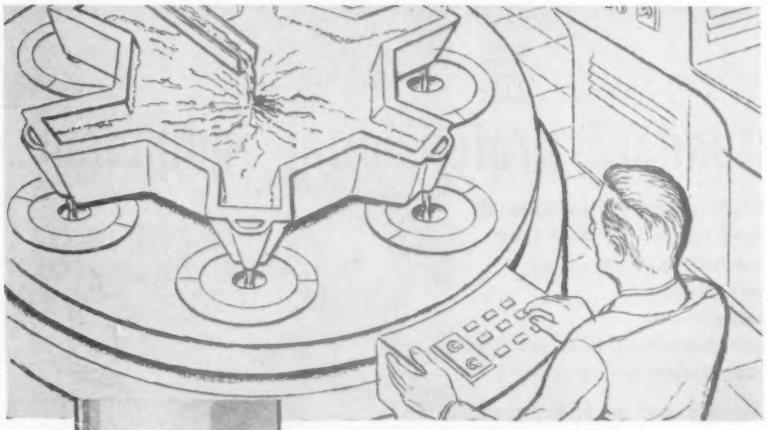
Available now from your local supplier of LINDE products. If you don't know him already, write for his name and address. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde TRADE-MARK

UNION CARBIDE

"Linde," "Oxweld," "Purox," "Prest-O-Lite," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.





Spectographic analysis assures strict adherence to specification.

Homogenized brazing alloys cut production costs!

New continuous casting of United Phoson and Sil-Bond alloys now results in the most uniform — homogenous — brazing alloys available. This technique assures more uniform results, speeds up production, reduces finishing requirements . . . for you! Always specify United homogenized alloys . . . certified to meet all standard specifications.

Complete information, and colorful new 8 page booklet "Low Temperature Brazing Engineering Facts and Data" are yours for the asking. Write, Wire or Phone

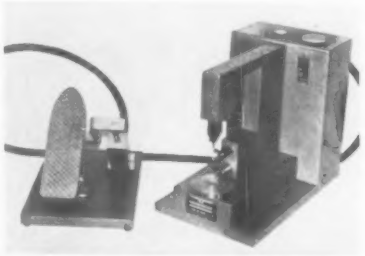
UNITED WIRE AND SUPPLY CORP.
1497 Elmwood Avenue, Providence 7, Rhode Island

Specify **UNITED** *for brazing alloys ... aluminum, brass, copper tube and wire*

Single-phase control

SWC-2X is a single-phase control for stationary or portable resistance welders. It has a dust-tight control cabinet, either a 200 or 400 amp safety fused-disconnect switch and can be used with single or multiple welding electrodes. Control has a 90 degree firing for first ½ cycle when used with grain oriented welding transformers. *Sciaky Bros., Inc.*

Circle No. 29



Weld head

USES of new hydraulic weld head and cabinet welder include welding aircraft components, electronic tubes and components, jewelry and light gage metals. Unit has welding cabinet enclosure with 2.5 kva welding transformer, integral hydraulic weld head, choice of welding controls and foot pedal hydraulic actuator. Low inertia movement with automatic weld firing pressure ranging from 0.5 to 100 lb. *Vacuum Tube Products Co.*

Circle No. 30

Ceramic tooling

PLATES and boats fabricated from "Sur Braze S-2" casting ceramic are used for critical sintering operations on metals, ferrites, ceramics and glass at temperatures of 3,000 F. The plates and boats have 1) purity of material, so tooling will not contaminate powders being sintered, 2) heat resistance to temperatures up to 3,000 F and 3) extreme resistance to thermal shock. *Duramic Products, Inc.*

Circle No. 31

Welding helmet

HELMET with a 4½ by 5¼ lens area is said to increase weldor's vision by 120%, and be a valuable aid to those who wear bi- or trifocal prescription glasses. The full gage vulcanized fibre helmet comes with a curved bottom going under chin, or with a straight bottom extending to chest. Accommodates lens shade 3 through 14. *Air Reduction Sales Co.*

Circle No. 32

Cold solder

NEW-principle plastic adhesive will eliminate use of liquid hardeners and form a bond with hard, durable, steel-like surface, manufacturer says. Twin Weld cold solder can be used to bind like metals or unlike substances such as metal and wood. It is easy to shape, cut and handle and has a long pot and shelf life. *Fyberglas Industries Div.*

Circle No. 33

MANHATTAN MOLDISCS

Faster Cutting—Longer Life

Tests have proved Manhattan Moldiscs to be the most economical portable grinding wheels you can use on right angle grinders . . . even on the toughest roughing and finishing jobs. They're custom-made to meet specific job requirements for use with mild steels, stainless alloys, aluminum or copper. Every turn of a Manhattan Moldisc exposes a fresh, sharp abrasive cutting surface right down to the last usable part of the wheel . . . *without* loading *or* glazing. They're safer and easier to use because they're light in weight, easy to control . . . and reinforced with special super-strength synthetic fabrics.

Manhattan Moldiscs are available in a wide range of types from harder, stiff bonds for fast roughing . . . to resilient, flexible bonds for fine finishing. Ask a Manhattan abrasive wheel engineer to show you how Manhattan Moldiscs and other Manhattan high speed, heavy duty abrasive wheels do a *better* cutting or grinding job and last *longer* . . . give you "More Use per Dollar".

RM-939

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

WELDING SCREENS

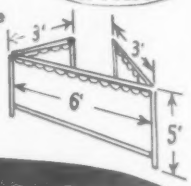
PROTECT

MERCHANDISE AND PERSONNEL

Work needn't stop for welding with these safe, lightweight, portable screens. Shield merchandise and other workers from welding.

- **Treated Canvas, Asbestos or Neoprene**
- **Flame, Water, Weather and Mildew Resistant**
- **Nominal Cost—Based on Size**
- **Hinged for Portability**
- **Eyelets Hold Curtains in Place**
- **Curtains Easily Removed or Replaced**

IT FOLDS



Protect merchandise with Folding Loading Dock Covers. Stock sizes and specials.

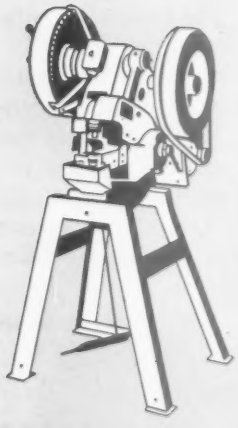
93 years service

Since 1865

A. MAMAUX & SON
120 BOULEVARD OF THE ALLIES
PITTSBURGH 22, PA. PHONE COURT 1-3500

Tarpaulins . . . 100,000 Square Feet in Stock

BATEMAN BANTAM IRON WORKER



THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operater by Hand or Foot

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch $575.00
Shear only $495.00

Shipping wt. 750 lbs.

WRITE TODAY for complete information and name of nearest distributor

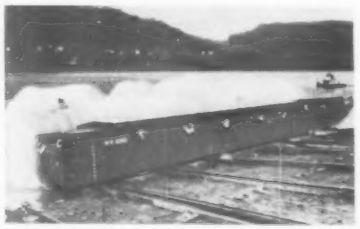
BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

NEWS . . . . . *from page 8*

safety. The course was designed so a uniform system of choosing inspectors will come about in the future.

In another course offered by the Canadian bureau, "Welding fundamental principles and practices," a section designed to give weldors an insight on leadership in the event they become foreman is included.

The lesson explains established principles of leadership and tells how to explain methods and techniques to subordinates. It also attempts to establish methods which will insure compliance to recognized design standards and procedures by operators and others.



3,000th marine hull launched at Ambridge

The MV 690 that dropped into the Ohio River recently was the 3,000th marine hull launched at the Ambridge Plant of United States Steel's American Bridge Div. in the past 55 years.

The 348-ton, 195-ft all-welded steel barge was built for the Mississippi Valley Barge Line Co.

Thompson

Bowers

Fibre-Metals forms midwest subsidiary

Fibre-Metals Products Co., Chester, Pa., has formed a new midwest subsidiary, Fibre-Metal Midwest Inc. The new company's offices and warehouse are located at 7412 S. Harlem Ave., Chicago.

F. M. Bowers II has been appointed general manager of the company, and J. R. Thompson has joined its sales staff.

The subsidiary will handle Glendale Optical products as well as Fibre-Metal products.

SIL-FOS—25 individual cartons per case containing 20 sticks per carton; .050″ x 1/8″ x 20″.

EASY-FLO 45—25 individual cartons per case, 17 pieces per carton. 1/16″ diameter wire in 20″ lengths.

New small packages of Easy-Flo and Sil-Fos

Low cost... Buy what you need... USE what you Buy!

Many users of silver brazing alloys can benefit from these small packages of EASY-FLO and SIL-FOS. No more on-the-job waste, exact amounts in small quantities do away with alloy "scrap" problem—"scrap" that costs you money. Now you can "carton out" your brazing alloy for each job and know how much you're using and how much you will need. Purchase by the case or carton, either way your alloy inventory is kept to the neatly packaged minimum.

Your supplier should have the new EASY-FLO and SIL-FOS packages on his counter now. Look for the familiar Handy & Harman blue and silver colors. GET WHAT YOU NEED—WHAT YOU CAN *USE* NOW!

DEALERS—WHOLESALERS!
Stock EASY-FLO and SIL-FOS now for maximum profit. These original silver brazing alloys outsell all other brazing alloys in the U. S. combined. For details and prices see any Handy & Harman distributor (list on request) or write direct.

Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

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BRIDGEPORT, CONN.
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OAKLAND, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

NEVER AGAIN!-cut-fit-trim-refit-recut-refit

do it once — do it right!

with the

PAT. NO. 2408517

H & M SHAPE CUTTER

Accuracy in cutting or beveling saddles, tees, els, or other designs has long been a time-consuming, trial-and-error process in pipe fabricating. Today, however, you can produce *precise* cuts and bevels *the first time*—with an H&M Shape Cutting Attachment!

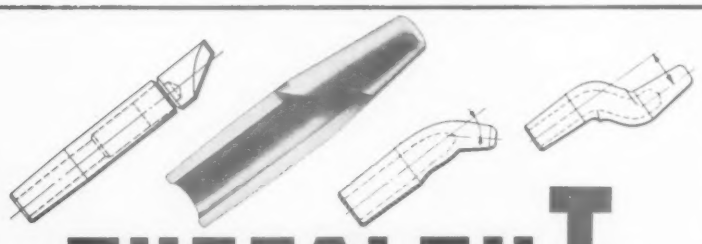
The H&M Shape Cutter is actually steered around the guiding template by exerting the proper spring tension on the sliding torch assembly. The cutting torch is thereby *forced* to reproduce the exact shape desired.

Eliminate those costly "re-cuts" and "re-fits" with an H&M Shape Cutter. Then—do it once, and you've done it right!

FULL DETAILS AVAILABLE IMMEDIATELY

H&M TM REG

PIPE BEVELING MACHINE COMPANY
311 E. Third St. Diamond 3-0241
TULSA, OKLAHOMA



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Resistance Welding Alloys

• **SPOTWELDING TIPS, a complete line** . . . R.W.M.A. Standard Tips, 'Tuffcap' Standard Tips, Cold-Formed Tips, Copper-Tungsten Faced Tips and many "Specials", all *carried in stock* in a wide selection of active types and sizes.

• **BAR STOCK,** round, hexagon, square and rectangular.

• **FORGINGS,** a large stock of bars and wheels available for finishing. Special forgings to order, rough, or finish-machined.

• **WELDING TIP HOLDERS and ADAPTERS**

You too may depend on *Tuffaloy,* with its record of over twenty years of prompt service and consistently high quality.

See your nearest AIRCO or TUFFALOY representative.

Ask for Catalog and Price List.

AIRCO ®

AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
150 East 42nd Street, New York 17, N.Y.

GOUGING torch by Arcair is used on the job to remove an unwanted half-inch of manganese steel on railroad crossover members. Torch directs stream of compressed air parallel to electrode. Method of removal was quicker and cheaper than grinding, and did not necessitate track removal or discontinuing operations.

PVRC meeting traces progress

The progress and accomplishments of the Pressure Vessels Research Committee of the Welding Research Council were reviewed at the committee's recent annual meeting at the Engineer's Club, New York City.

Fred L. Plummer, national secretary of the American Welding Society, and chairman of the group, addressed the meeting. He stressed the importance of research and its worth to industry. He stated that the findings of the PVRC have influenced the establishing of many standards.

Plummer cited the atomic submarine *Triton*, the aircraft carrier *Independence*, missiles and rockets as examples where welded pressure vessel developments have at least been influenced, and to some extent made possible, by the research of committees such as the PVRC.

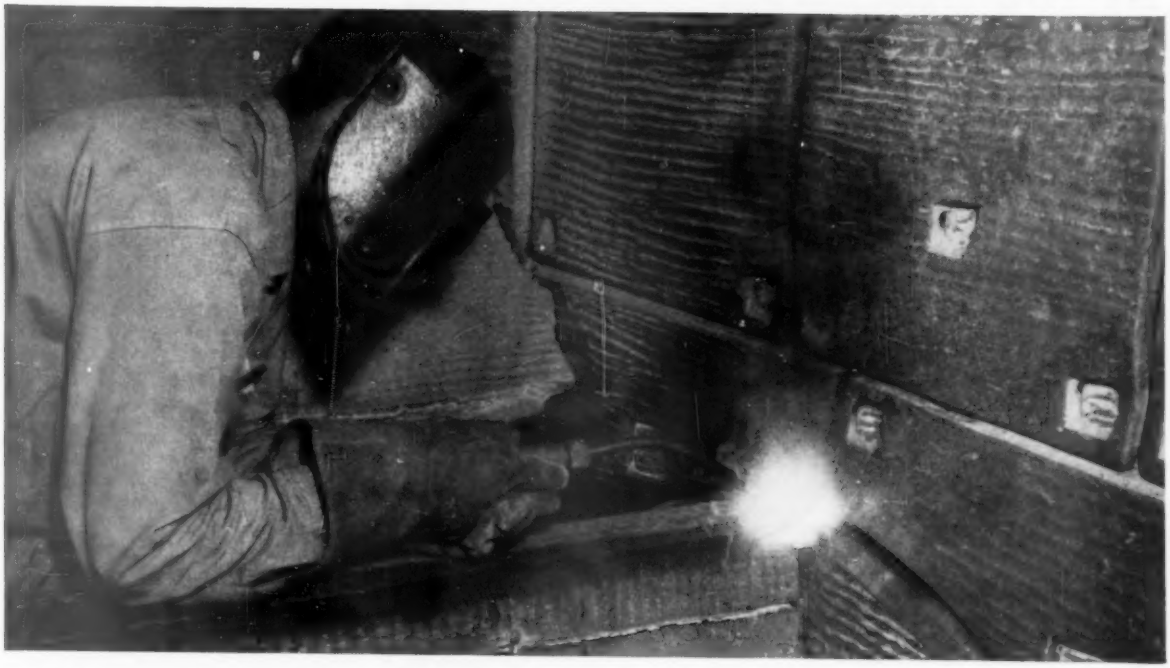
The committee consists of 200 scientists who serve on the PVRC's three sections—materials, design and fabrication.

Shortly before the committee met Plummer appeared at a research forum held by the American Gas Association in Tulsa, Okla. In his address he told of the work of the American Welding Society and the PVRC.

Name change for Hunt Co.

C. B. Hunt and Son Inc., Salem, Ohio, has changed its name to Hunt Valve Co., so its name will be more closely identified with its products.

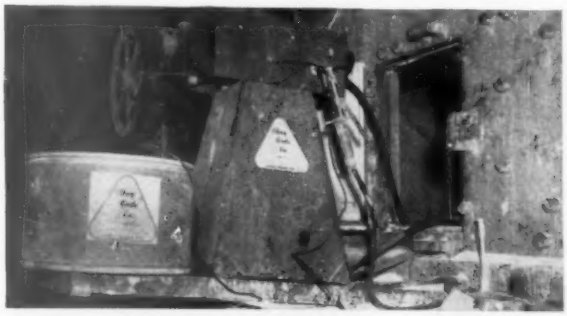
How semi-automatic hard surfacing saves time and material at Bradford Hills Quarry



"Changing to the semi-automatic application of nickel manganese surfacing material almost saved us the price of the Wear-O-Matic machine in just five weeks," says Thomas Risbon, Welding Foreman for Bradford Hills Quarry, East Petersburg, and Downingtown, Pa.

The Wear-O-Matic unit at Bradford Hills Quarry is used almost exclusively for maintaining their new 57-60 Universal Impactor. Over a five week period, nightly maintenance on this crusher required 500 pounds of 7/64" Wear-O-Matic nickel manganese wire to provide normal operating tolerances. During a similar period, 800 pounds of ¼" nickel manganese stick electrodes were required to provide the same amount of wear protection to the impactors.

Savings in maintenance operations in your industry are important because they affect profits. Find out how the Wear-O-Matic process can help lighten your maintenance load. It's built right and priced right* to provide for you the most efficient maintenance on all equipment subject to wear. Request Bulletin HS-102 Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.



From this platform on the crusher, the Wear-O-Matic unit is used nightly to maintain proper impactor size for most efficient operation.

Weldor Gene Johnson says, "It's easy to turn out square edged impactors like this with the Wear-O-Matic process and, it's less tiring than stick electrodes."

* Price f.o.b. York, Penna. $279.00.

QUALITY WELDING ELECTRODES FOR

Stainless Steel
Mild & Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

Alloy Rods Company

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BUT THERE'S A BIG DIFFERENCE INSIDE

. . . AND THE BIG DIFFERENCE INSIDE ACETYLENE CYLINDERS IS COYNE'S SPECIAL FORMULA MAGIC MONOLITHIC FILLER. THERE'S ALWAYS GRADE A QUALITY INSIDE EVERY COYNE CYLINDER—LET US PROVE IT.

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24 COMMERCE STREET, NEWARK, N. J.

Airco building Denver gas plant

Air Reduction Co., Inc., New York City, is building a $600,000 oxygen and nitrogen producing plant in Denver.

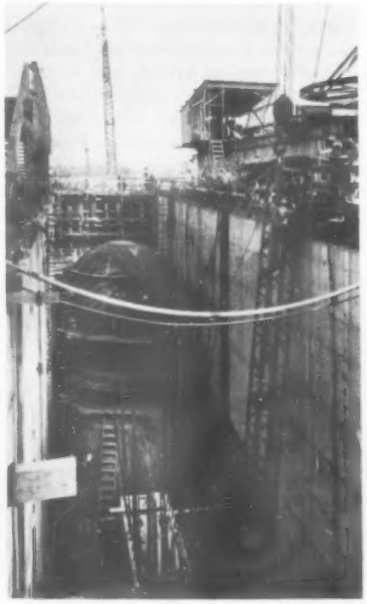
William O. Brown is in charge of all Denver Airco operations, which until now consisted of a supply source for welding and cutting equipment, and a source of argon and helium gases.

The new plant is expected to be in operation by 1959. Its products will be used in the metal working and construction industries and in missile development.

Lincoln builds Australian plant

Lincoln Electric Co. (Australia) Ltd., subsidiary of Lincoln Electric Co., Cleveland, is building a plant in Sydney for the manufacture of arc welding equipment and supplies.

The plant is modeled after Lincoln's Cleveland plant. It will be completely windowless and air conditioned. Entrance will be through two tunnels.



FIRST commercial use of the atom is in this reactor container, almost buried in concrete work, at the Shippingport atomic power station. Built by Pittsburgh-Des Moines Steel Co., it is made of 1½ steel. Joints are beveled with a 40 degree angle leaving a ⅛ in. land and are fit up with a 5/32 in. root opening. A 3/16 E-6010 electrode was used throughout.

COMING EVENTS

NOV. 11-12: Northwest Welding Conference, University of Minnesota, Minneapolis, Minn.

DEC. 1-2: NWSA Southeastern Zone Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

DEC. 4: NWSA Southwestern Zone Meeting, The Statler Hilton, Dallas, Tex.

DEC. 4: NEMA Arc welding Section Quarterly Meeting, Chicago.

JAN. 8-10, 1959: NOIMA Trade Show and Exhibit, Atlanta Biltmore Hotel, Atlanta, Ga.

JAN. 26-29: Plant Maintenance and Engineering Show, Cleveland Public Auditorium, Cleveland.

JAN. 28-29: Midwest Welding Conference, Illinois Institute of Technology, Chicago.

MARCH 12, 1959: NEMA Arc Welding Section Quarterly Meeting, Pittsburgh.

MARCH 16-20, 1959: ASM Western Metal Exposition and Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.

APRIL 7-10: 1959 AWS Welding Show, International Amphitheater, Chicago, Ill.

JUNE 4-5, 1959: NEMA Arc Welding Section Quarterly Meeting, Hot Springs, Va.

Pipeline news

The Federal Power Commission authorized the construction of $518,822,000 in natural pipeline facilities during the 12-month period ending June 30, 1958. The new facilities were designed to add 2¼ billion cu ft of daily delivery capacity to the nation's transmission system.

Michigan Wisconsin Pipe Line Co., Detroit, has been granted FPC authorization to construct 25.3 miles of 12¾ in. loop line to its Madison, Wis., lateral. It will also install a 1,200 horsepower compressor unit at its Wisconsin "B" station. The cost of construction will be $1,433,000. This is part of the company's $22,000,000 project to increase its system's capacity by 40,000,000 cu ft daily.

Distributor appointments

Automatic Switch Co., Florham Park, N. J.; Control Equipment Co., Salt Lake City, Utah.

American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill.; Kern Welding Supplies, Bakersfield, Calif.; Wesco Corp., Charleston, W. Va.; Wilcher Welding Supply, Macon, Ga.; General Welding Supply Co., Denver, Colo.

Olin Aluminum, Olin Mathieson Chemical Corp., New York, N. Y.; Seneca Steel Service, Inc., Buffalo; Steel Supply Co., Knoxville, Tenn.; Universal Steel Co., Cleveland.

Keleket X-Ray Corp., Waltham, Mass.; RCA Victor Co., Ltd., Montreal.

GOOD WELDERS DO BETTER
with these and other
ADVANCED ALL-STATE ALLOYS
All-State
FLUXES
This trade-mark is reserved for the finest ALL-STATE has in FLUXES, FLUX-COATING, ALLOYS
Alloys and Fluxes for joining ALL METALS ALL METHODS
TORCH WELDING
SOLDERING • FILLING • SEALING
TORCH BRAZING
FURNACE BRAZING
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ALL-STATE FLUX-COATED RODS HAVE ALL 3

Save Time! Money! Rework!

Nickel Silvers	No. 11FC Brazing Rod No. 13FC Buildup Rod
Bronzes	Flux-Coated, Low-Fuming Rod** No. 41FC General Purpose Brazing Rod
Aluminum	No. 35FC Special Light-Coated Welding Rod E-43 Electrode for Type 4043 E-2 Electrode for Type 1100

**This flux-coated, low-fuming bronze is typical of All-State flux-coated rods . . . speeds work by permitting operator's undivided attention to deposition and control. *Odor practically non-existent.* Flux coating is All-State formula of proven superiority and years-standing reputation for the rapid, positive, smooth cleansing action important to good brazing . . . is anhydrous . . . causes bronze to flow out more freely and smoothly.

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Distributor stocked everywhere! Convenient to buy! Economical to use!

Want your own bronze flux-coated? If you are committed to other alloys and need the economies inherent in having the flux on the rod, inquire! All-State's manufacturing subsidiary is available for **custom coating** with All-State Fluxes.

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MATERIAL HANDLING DEVICES

- Safety Factor—5 to 1
- Factory tested at triple rated capacity.
- Will lift from horizontal or vertical position.
- Cam and Pads of case hardened tool steel.
- All operating parts replaceable when worn.
- Swinging or jerking loads will not affect grip.
- Useful for positioning in welding operations.

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the BEST...
MANGANAL
11¾-13½%
MANGANESE-NICKEL STEEL
BARE WELDING ELECTRODES
TOP WELDERS CHOOSE MANGANAL BARE because:
1. It makes the strongest welds fastest.
2. No coating; no slag; no chipping.
3. Workhardens to 550 Brinell; tensile strength, 150,000 psi.
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For the most effective and economical reclamation welding of parts worn through impact and abrasion.
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SOLE PRODUCERS
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PORT AVENUE at JULIA ST. ELIZABETH, NEW JERSEY
Write for complete details and nearest distributor.

ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!

- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
- Makes it easy to mark off end of lateral pipe.

NO MISTAKES — NO TIME LOSS

—regardless of the type or size of pipe joint to be welded. No more "cut and try" with a CONTOUR MARKER — it eliminates the need for calculation, and is available in 2 sizes for marking pipe and structurals of 1½" to 18" in cross section, and from 16" to 48" diameter. Send for complete description.

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1843 E. Compton Bl., Compton, Cal.
Also Mfgrs. of Boyce Centering Heads, Radius Markers and Pipe Flange Aligners.

THE CONTOUR MARKER

TILLMAN
Gloves—Garments

WELDORS BUY FROM YOUR DEALER

ASK FOR OUR NEW CATALOG

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
Long Beach, Calif.

Cyril D. Jensen has taken a leave of absence from Lehigh University, Bethlehem, Pa., to direct research and testing for the Pennsylvania Department of Highways. He is chairman of the soil mechanics division and a professor of civil engineering at the university. While doing research for the Navy during World War II he developed underwater cutting and welding techniques and did stress investigations of welded propeller shafts and other weldments. During this time he obtained a patent for a coated underwater cutting electrode.

Alloy Rods Co., York, Pa., has appointed *Harold Scrutton* as field representative for south-central Pennsylvania and Maryland. *Joseph Williams* is filling the newly created position of manager of market research. Both men will headquarter in York.

Scrutton

Williams

About

Cary

Gehring

Director of the new Hobart Bros. Technical School in Troy, Ohio, is *Howard B. Cary*, former assistant general works manager of the Marion Power Shovel Co., Marion, Ohio. Cary is a member of the American Welding Society Welding Handbook Committee, and a graduate welding engineer of Ohio State University.

New sales manager of the Cayuga Machine & Fabricating Co., Inc., Depew, N. Y., is *Robert P. Gehring*. He is former vice president of Saginaw Welding Supply Co., and former chairman of the Niagara section of the American Welding Society.

Walter A. Penner has been appointed district office manager of Worthington Corp.'s Denver district office. Penner is a graduate mechanical engineer from Stevens Institute of Technology, Hoboken, N. J., and is a licensed engineer in California.

Fred S. DeWitt is the new district distributor sales manager in New York City for General Electric tubes and electric components. DeWitt replaces *S. J. Welsh* who is now marketing manager for the company's specialty electric components department in Auburn, N. Y.

Former assistant sales manager of Air Reduction Co.'s New Orleans sales office, *Fred T. Wilson, Jr.* now manages that location. *E. C. Kennedy* is the new assistant sales manager.

Kennedy

Wilson

people . . .

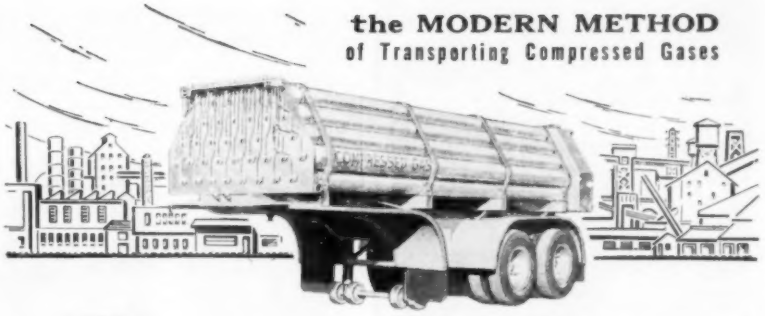
Becker

Christenberry

Seymour Becker has been appointed New England field representative for Arcair Co., Lancaster, Ohio. Becker has experience as weldor, salesman and welding instructor.

Former sales representative of Smith Welding Supply & Equipment Co., Detroit, *S. E. Christenberry*, is now the firm's sales manager. He was at one time a district engineer for Eutectic Welding Alloys Co.

Bob Hairston is the new executive secretary of the National Ornamental Iron Manufacturers Association. He will serve a one-year term.



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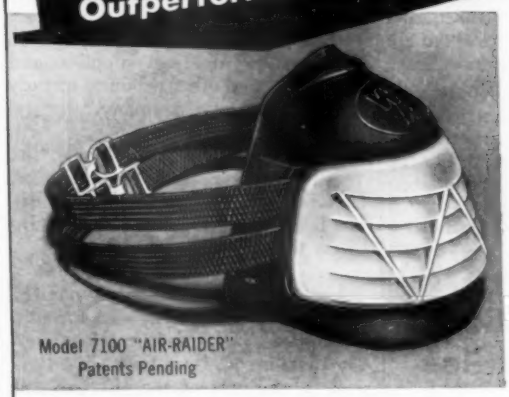
REVOLUTIONARY NEW WELSH AIR-RAIDER RESPIRATOR
Outperforms them all



ACTUAL LABORATORY COMPARISON TESTS PROVED THESE COMPETITIVE ADVANTAGES OF THE FIRST ALL PLASTIC RESPIRATOR

- 47% to 51% Less Weight
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FOR PROTECTION AGAINST Dusts, Chromic Acid Mists and Pneumoconiosis-Producing and Nuisance Mists. Bureau of Mines Approval BM 2175.

TRY IT AND COMPARE IT! The Welsh AIR-RAIDER is more comfortable . . . provides a longer filter life . . . gives greater visibility . . . is more durable and is easily assembled. Write for Bulletin Today!

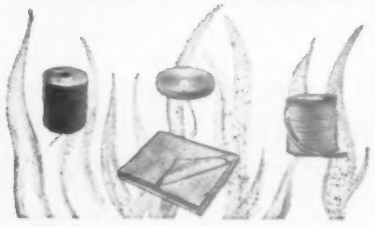
WELSH MANUFACTURING COMPANY
4 Magnolia Street, Providence, R. I.

...made of J-M Asbestos Cloth by prominent Chicago manufacturer

● Here's an excellent unit for on-the-spot handling of fires—the Fite Rite Blanket in the flip-open case for split-second protection of equipment and personnel. Made of Johns-Manville Asbestos Cloth—in commercial and Underwriters' grades to AAA—the Fite Rite Blanket is produced by Cotton Goods Mfg. Co., 216 N. Clinton St., Chicago, Ill. Standard blankets and curtains made of J-M Asbestos Cloth are also included in the Fite Rite Line.

Fabricators of top-quality clothing, curtains, and other protective materials offer J-M Asbestos Cloth in the forms that are most practical in your operation. For the name of your local distributors and fabricators of products made of J-M Asbestos—or for free booklet TX-2A—write Johns-Manville, Box 14, New York 16. In Canada, Port Credit, Ont.

Johns-Manville Asbestos Textiles



The new general manager of Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa., is *Joseph N. Kemple*, former company sales manager. Kemple was at one time connected with US Steel.

Kemple

Smith

J. E. (Jack) Smith has been elected to the newly created position of executive vice president of Smith Welding Equipment Corp., Minneapolis. Smith, son of the company's founder, organized and formerly headed the company's research and development department.

John A. Houston has been appointed assistant general sales manager of the Philadelphia steel service plant of Joseph T. Ryerson & Son Inc. Houston was assistant general manager of sales for all Ryerson plants. *Hardie W. Beck* was named general manager of the company's Pittsburgh plant.

Raymond A. Harder is manager of the new midwestern division of the Coyne Cylinder Co., in Glenview, Ill.

A new department at Metal & Thermit Corp., New York City, will be directed by *H. E. Hirschland*, and managed by *C. H. Carpenter*. The department will stress the development of new metals and chemicals, and do research on welding supplies and equipment and other products already being made by the company.

Bay State Abrasive Products Co., Westboro, Mass., has added *James A. Cloutier* to its Chicago sales force. He has been assigned to the northern Indiana territory.

John R. Burwell has been appointed manager of government sales for Olin Aluminum, Div. of Olin Mathieson Chemical Corp., New York City. Burwell, a graduate of the U. S. Naval Academy, was with the company's research division.

A former vice president of Pittsburgh Plate Glass Co., *Wallace R. Harper*, has been appointed assistant executive vice president of the American Institute of Steel Construction, New York City.

SHOOT-A-LITE
SAFETY GAS LITER

The Practical Lighter for welding and cutting torches

SAFE! SURE! STRONG!

Ask your jobber or write us.

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Black Beauty

Singer's new lightweight safety clothing and gloves for inert gas arc welding

★Welders gloves and mittens

★ Jackets ★ Sleeves (all types)
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Safety experts agree this beautiful dull black color is the best protection against the greater threat of ultra-violet rays in inert gas arc welding. The leather is about **ONE-HALF** the usual weight, specially tanned to make it soft and pliable. This lack of bulk brings amazing comfort.

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Complete line of work gloves for every job, safety clothing and welders gloves.

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CABLE LUGS
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Seamless and stoutly reinforced with new plastic, ratchet headgear. Easily adjusts to any headsize.

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NEW DESIGN ADVANTAGES

1. Lighter weight.
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These and other advantages give you better protection, comfort and ECONOMY.

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Enjoy real savings with Flood's
1000-HOUR COVER LENSES
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AT YOUR DISTRIBUTOR OR WRITE:

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3035 West Lake Street, Chicago 12, Illinois

30 YEARS AGO

(Taken from the *Welding Engineer* of November, 1928)

Workmen of the Bethlehem Steel Co. are welding a $250,000 addition to an Atlantic City power plant. A General Electric 400-amp arc welder is being used on the all-welded eight-story building.

—30 YEARS AGO—

Education was stressed at the convention of the International Acetylene Association in Chicago. Speakers at the three-day meeting included Harold S. Card, editor of WELDING ENGINEER; John J. Crowe, Air Reduction Co. and J. I. Banash, consulting engineer.

—30 YEARS AGO—

Electric Arc Cutting & Welding Co., Newark, N. J., contributed several welded I-beam assemblies to Columbia University, New York City. The beams were used by the university's testing laboratories to gain data on strength of welded structures.

—30 YEARS AGO—

J. I. Banash, consulting engineer for the International Acetylene Association, spoke at the Master Steamfitters of Chicago luncheon in the Bismarck hotel. His topic concerned industrial pipe welding, its economies and probable future developments.

—30 YEARS AGO—

Stuart Plumley has resigned his position as secretary of the Gas Products Association to take a post with Smith Welding Equipment Corp., Minneapolis.

—30 YEARS AGO—

An article by E. D. Lacy, Alloy Welding Processes Ltd., London, traces the progress that has been made in welded construction and repair in British shipbuilding circles.

—30 YEARS AGO—

To accommodate the increased force at Stoody Co., Whittier, Calif., the sales force, purchasing department and general superintendent will move into a soon-to-be-completed addition to the company's office building.

—30 YEARS AGO—

Prest-O-Lite Co. has opened its 35th gas plant in the country. The new plant, located in South Charleston, W. Va., will supply acetylene for welding and cutting to local industry.

NOW
TUNGSTEN CARBIDE HARD FACING
with the METCO ThermoSpray Gun

Now you can apply coatings of this extremely hard material with the required concentration of carbide, to any desired thickness, with a low-cost installation in your own plant, or have it done at reasonable cost in a metallizing job shop.

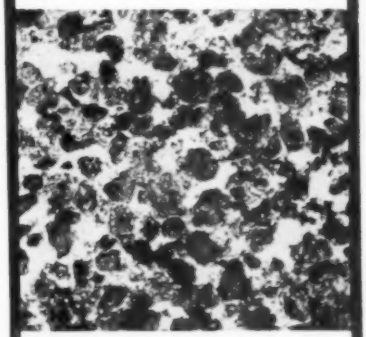

Photo-micrograph of sprayed coating, showing high tungsten carbide (dark particles) concentration. Mag. 50x – actual size of area shown, approx. .040" x .040". (Photo courtesy Sam Tour & Co., Inc.)

These coatings are non-porous, homogeneous, have very high tensile strength and provide excellent wear resistance under the most extreme service conditions.

For full details—write, wire or phone for Bulletin 139. No obligation, of course.

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1127 Prospect Ave., Westbury, Long Island, New York EDgewood 4-1300
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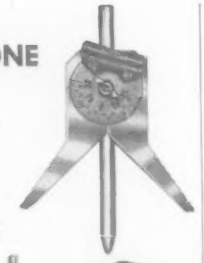
Yes, actually a BOYCE Centering Head replaces

- ✓ The Protractor
- ✓ The Centerhead
- ✓ The Center Punch
- ✓ The Level
- ✓ The Scale

Determines Center Line at any Degree and Measures Degree of Declivity



Weighs only 9 ozs. Pocket size.

DIAL SET LEVEL

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

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has everything for
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The complete one-order supplier for you!
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"CS" Welding Electrodes—Specially designed for welding cast iron to steel or cast iron to cast iron. Clean spatter-free welds! Costs less than other rods for welding cast to steel!

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51. FILLER WIRE—Kaiser Aluminum. The importance of filler wire surface quality in high strength aluminum welding is covered in booklet. Reprint tells sizes of proper electrodes and rods, how they are packaged, cared for and stored.

52. REGULATOR REPAIR—Modern Engineering Co. Bulletin gives detailed instructions for installation of new seats in welding and industrial regulators in order to reduce maintenance costs and downtime.

53. X-RAY SYSTEM—General Electric Co. Data Sheet B3022 tells of company's TVX X-ray image intensification system. Tells applications and features.

54. HOLDER—Martin Wells. Bulletin 758 describes Tong-Grip electrode holder. Gives pictures and specifications.

55. SPOT WELDER—Peer Inc. Rex Junior portable spot welder is detailed in 2-page catalog. Exclusive fixed top-tong feature is explained.

56. GOGGLE—American Optical Co. Bulletin S-7311 describes new flexible mask goggle that fits over all types of personal and safety prescription glasses.

57. GALVANIZED PAINT—Shivell-Hall Co., Inc. Four-page flyer tells various uses Galvanox, a paint that repairs damaged galvanized surfaces, can be put to.

58. TITANIUM — Mallory-Sharon. Brochure tells of the corrosion resistance and strength weight ratio of titanium.

59. BENDING MACHINE—Wharton Unitools. Literature explains Refix bending machines that are hydraulic and motorized. Machine bends, mills, threads and cuts, in one setting.

60. FORGINGS—Merrill Bros. Catalog F-1 has information on everything from die design through forging methods, trimming, cleaning and inspection.

61. SELENIUM DIODES — International Rectifier Corp. Engineering data on subminiature selenium diodes is given in bulletin SR-163. Includes graphs and charts.

62. METALLIZING — Metallizing Engineering Co., Inc. The practical applications of metallizing are covered in bulletin 51C-18M/5-56.

63. BRAZING—United Wire & Supply Corp. Four-page flyer describes color movie that tells what happens "When metals are brazed. . ."

64. ACCESSORIES — National Cylinder Gas Co. Form N-213 catalogs welding accessories in company's line. Includes electrode holders, flux, safety equipment, clamps, etc.

65. HEAT TRANSFER—Babcock & Wilcox. The quality, dependability and economy of electric resistance welded carbon steel tubing in applications involving heat transfer are described in bulletin TB-412.

66. ELECTRIC PLANTS—Automatic Switch Co. Electric plants, with all their components, are described in catalog 57-S6. Includes pictures, specifications and prices.

67. BERYLLIUM—Beryllium Corp. "Plain talk or beryllium" tells of the health hazards that exist when the substance is not properly handled, what one can do to avoid improper handling and what to do should an accident occur.

68. RECTIFICATION PLANTS—Superior Air Products Co. Catalog describes plants for the production of oxygen and nitrogen in liquid or gaseous forms. Includes technical data, and illustrations of pumps, vaporizers and other equipment.

69. DUCTILE IRON—T. B. Wood's Sons Co. Bulletin 1102 builds a case for ductile iron by claiming its low melting points, fluidity, casting and machining advantages are comparable to cast iron, and yet it has steel's strength and ductility.

70. BRAZING MANUAL—All-State Welding Alloys Co., Inc. Book gives basis for self-instruction or on-job training in methods of joining metals.

71. SPECTROMETER — Tracerlab Inc. CE-9 is a booklet telling of company's iron-jacketed, intermediate image Beta-Ray Spectrometer.

72. BATH—Acoustica Associates, Inc. Detailed and pictured in bulletin Sol 109 is company's ultrasonic soldering iron and tinning bath.

73. FOREIGN LICENSING—Pegasus International Corp. Problems of foreign licensing are answered, and information on this activitiy is given in special booklet.

74. FILM BADGES—St. John X-Ray Laboratory. Leaflet tells of new service which provides subscriber with one year supply of film badges, film and personal consultation. Badges are used to monitor people exposed to radiation.

75. CUTTING MACHINES — American Messer Corp. Brochure describes line of cutting machines for various operations.

76. STUD WELDING—KSM Products Inc. Leaflet pictures PS-1 percussive stud welding unit in operation and tells what it can do.

77. X-RAY CLINIC—Westinghouse X-Ray Dept. Booklet shows how the use of X-ray in industry can save manufacturer money. Tells of radiographic applications.

78. PUBLICATION — National Electric Welding Machines Co. Volume 2, No. 3 of "Welding News" is available. Issue deals with custom-engineered welding machines.

79. SCHOLARSHIP—Foundry Education Foundation. Brochure describes Wheelabrator Fellowship program available to those in the cast metal industry, among others. Fellowship is sponsored by Wheelabrator, Mishawaka, Ind.

80. ALUMINUM RAILING—Michael Flynn Mfg. Co. Bulletin PW-210 gives complete specifications, design data, and isometric and orthographic dimension drawings for 43 sizes of cast aluminum railings for bridges and highways.

81. PREFORMS—Duramic Products Inc. Bulletin 114 describes Epoxweld 100 preforms, a single unit Epoxy preform used in automatic or production joining, sealing or encapsulating metals, ceramics and glasses.

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Welding Engineer published monthly (two issues in June) at Chicago, Ill., for October 1, 1958.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; Editor, T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Managing editor, Jack Fairlie, 5826 Dempster St., Morton Grove, Ill.; Business manager, T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Elsie R. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Anna B. Jefferson, 12 West 58th St. Terrace, Kansas City 13, Mo.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

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T. B. JEFFERSON, Editor, Publisher

Sworn to and subscribed before me this 4th day of October, 1958.

[SEAL] ROLAND F. DILG

(My commission expires April 12, 1962)

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District Sales Manager with real ability in sales and management. Wide knowledge of coated electrode and automatic alloy welding required. Established, highly respected company offers excellent base and incentive pay, company car, fringe benefits. Write Box No. 1132 C/O Welding Engineer, 5826 Dempster, Morton Grove, Ill.

Experienced welding supply salesman to work in South. No traveling. Give all details in first letter. Information confidential. Write Louisiana Welding Supply Co.

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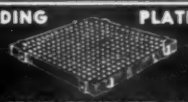

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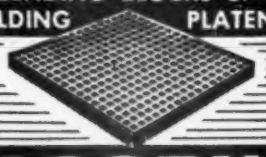

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JOBBERS WANTED IN EVERY CITY TO SELL "WELDER'S PAL" EYE DROPS
On the market for 20 years
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Write for free 32-page complete line catalog

Sold through leading distributors
Adjustable Clamp Co.
"the clamp folks"
426 N. Ashland Ave. Chicago 22, Ill.

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Adjustable Clamp Co. 93
Airline Welding & Engineering 70
Air Reduction Sales Co. 14
Air Reduction Sales Co. Tuffalloy Dept. 84
Alloy Rods Co. 16, 85
All-State Welding Alloys Co., Inc. 87
Aluminum Co. of America 64, 65
Alva Allen Industries 80
American Brass Co. Back Cover
American Chain & Cable Co., Inc., Page Steel & Wire Div. 68, 69
American Manganese Steel Div. American Brake Shoe Co. 56
American Optical Co. 73
American Platinum & Silver Div. Engelhard Industries, Inc. 55
Ampco Metal, Inc. 58
Arcos Corp. 76, 77
ASEA Electric Co. 4
Atlantic Abrasive Corp. 62
Atlas Welding Accessories, Inc. 26

Bateman Foundry & Machine 82
Belden Mfg. Co. Inside Front Cover
Bernard Welding Equipment Co. 5

Cam-Lok Div. Empire Products, Inc. 50
Contour Marker Corp. 88, 92
Coyne Cylinder Co. 86

Duro Engineering Co. 71

Engelhard Industries, Inc. American Platinum & Silver Div. 55

Fibre-Metal Products Co. 66
Flood Safety Products Co. 91

Goldsmith Bros. Smelting & Refining Co. 63

H & M Pipe Beveling Machine Co. 84
Handy & Harman 83
Harrisburg Steel Co. 57
Hobart Bros. Co. 1, 2

Independent Engineering Co., Inc. 89
International Nickel Co. 25
Invincible Vacuum Cleaner Mfg. Co. 78

Jackson Products 6
Johns-Manville Corp. 90

Kaiser Aluminum & Chemical Sales, Inc. 51
Kennametal Inc. 52

Lenco, Inc. 91
Lincoln Electric Co. 28
Linde Co. 27, 53, 79

A. Mamaux & Son 82
McKay Co. 12
Manhattan Rubber Div. Raybestos-Manhattan, Inc. 81
Merrill Bros. 87
Metal & Thermit Corporation 47
Metallizing Engineering Co., Inc. 91
Miller Electric Mfg. Co., Inc. Front Cover, 24

National Carbide Co. 86
National Electric Welding Machines Co. 45
National Welding Equipment Co. 9
Norris-Thermador Corp. 61

Page Steel & Wire Division American Chain & Cable Co., Inc. 68, 69
Phoenix Products Co. 65
Picker X-Ray Corp. 13
Pressed Steel Tank Co. 72

Rankin Mfg. Co. 59
Raybestos-Manhattan, Inc. Manhattan Rubber Div. 81

Shoot-A-Lite Corp. 90
Singer Glove Mfg. Co. 90
A. O. Smith Corp. 17-22
Smith Welding Equipment Corp. 74
Square D Co. 49
Stulz-Sickles Co. 88
Sylvania Electric Products Inc. Inside Back Cover

Tempil Corp. 54
Tennessee Fabricating Co. 92
Tillman & Co., John 88
Tuffalloy Dept. Air Reduction Sales Co. 84

United Wire & Supply Corp. 80

Victor Equipment Co. 30

Welsh Mfg. Co. 89
Westinghouse Electric Corp. 10, 11
Westinghouse X-Ray Div. 75

Literature offered in ads

125. Adjustable Clamp Co.—Catalog on complete line of "Jorgensen" and "Pony" Clamps.

126. Airline Welding And Engineering—Write for complete information on "Airline Longitudinal Welding Positioners" and accessory equipment.

127. Air Reduction Sales Co.—Information on the new contact tube with "floating Chuck" to improve your "Aircomatic" welding guns.

128. Alloy Rods Co.—Bulletin AR-102 will help you with your stainless steel welding problems.

129. Alloy Rods Co.—Bulletin HS-102 on the "Wear-O-Matic" process can save you maintenance operations in your industry.

130. All-State Welding Alloys Co.—Further information on flux-coated rods; also new instruction manual available.

131. Aluminum Co. of America—Write for informative books and free loan of films on joining of aluminum.

132. Alva Allen Industries—Catalog available giving complete information specifications and prices on Allen's heavy duty punch presses.

133. American Brass Co.—Write for more information on braze-welding and for technical assistance on your welding problems.

134. American Manganese Steel Div.—Further information available on "Amsco" manganese steel plate linings.

135. American Optical Co.—Write for further information on the American Optical weld-cool welding helmet.

136. American Platinum & Silver Div.—Two complete reference manuals for low temperature siver brazing and fluxing are available.

137. Ampco Metal, Inc.—Catalog, price list and name of your nearest distributor is available for "Ampco-Weld" electrodes.

138. ASEA Electric Co.—Brochure on "Type SVU Aseasvets," automatic flash welding machines.

139. Atlantic Abrasive Corp.—Copies of the Atlantic grinding wheel catalog are available.

140. Atlas Welding Accessories Inc.—Further information available on the Atlas line of weld cleaning tools.

141. Bateman Foundry & Machine—Complete information on the "Bantam Iron Worker" available, also name of nearest distributor.

142. Belden Mfg. Co.—Further information available on Belden's engineered welding cables.

143. Bernard Welding Equipment Co.—Further information available on the "Shortstub" electrode holder.

144. Cam-Lok Div.—Write for catalog No. 131-B on the complete Cam-Lok line of neoprene insulated cable connectors and cable splicers.

145. Contour Marker Corp.—Details on establishing and marking a point at any angle.

146. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

147. Coyne Cylinder Co.—Write for details on Coyne Acetylene Cylinders.

148. Duro Engineering Co.—Further information on Duro's standard holder and the new "Durogon" holder.

149 Fibre Metal Products Co.—Write for bulletin 65 on "Supergrip" electrode holder.

150. Flood Safety Products Co.—Information available on fiber glass helmets manufactured by Flood and other welding and safety equipment.

151. Goldsmith Brothers Smelting & Refining Co.—For complete information on low temperature silver brazing write for a copy of the GB data book.

152. H & M Pipe Beveling Machine Co.—Full details available on the H & M "Shape Cutter."

153. Handy and Harman—Write for details and prices on the new small packages of "Easy-Flo" and "Sil-Fos" silver brazing alloys.

154. Harrisburg Steel Co.—Further information available on mobile gas storage.

155. Hobart Brothers Co.—Complete details on the new Hobart air-cooled "Migare" process and how it can increase your production.

156. Hobart Brothers Co.—Further information available on the complete line of Hobart's arc welding equipment, also catalog on electrodes.

157. Independent Engineering Co.—Further information available on transporting gases by gas supply trailers.

158. International Nickel Co.—"Repair Cast Iron Parts Quickly and Easily" explains the Ni-Rod "55" story.

159. Invincible Vacuum Cleaner Mfg. Co.—Write for folder on "Invincible Flux Recovery Systems."

160. Jackson Products—Futher information available on Jackson's "Featherlight" electrode holders.

161. Johns-Manville Corp.—Booklet TX-2A on Johns-Manville Asbestos cloth and name of your local distributor and fabricator is available.

162. Kaiser Aluminum & Chemical Corp.—Further information available on the new "King" brand welding wire for high strength welding.

163. Kennametal Inc.—New descriptive literature on "Kenspray" and names of job shops in your area equipped to apply it, is available.

164. Lenco, Inc.—Further information available on "Swedg-On" cable lugs designed especially for welding cable by Lenco.

165. Lincoln Electric Co.—Bulletins SB-1364 and SB-1343 are available on Lincoln's arc welding equipment.

166. Linde Co.—Further information on "Heliarc" cutting is available.

167. Linde Co.—Catalog F-4487 on Linde's complete line of "Oxweld" portable cutting machines.

168. Linde Co.—More information about the "Purox W-200 Starter Set" and name of your local supplier.

169. A. Mamaux & Son—Further information available on welding screens.

170. Manhattan Rubber Div.—Data available on "Manhattan Moldiscs" the portable grinding wheels.

(Continued on page 96)

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 70 to 80

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For copies of any manufacturers' bulletins described on these pages, circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 70.

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51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

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Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Literature offered in ads

(Continued from page 94)

171. McKay Co.—Write for the new McKay "Hard Surfacing" catalog.

172. Merrill Brothers—Information on material handling devices available.

173. Metal & Thermit Corp.—Write for a copy of the M & T Electrode Selector, for choosing the correct electrode for any application.

174. Metallizing Engineering Co. Inc. —Bulletin 139 available on tungsten carbide hard facing with the "Metco" ThermoSpray Gun.

175. Miller Electric Mfg. Co. Inc.—Complete particulars, specifications and prices on Miller welders including the new "BW Electric Control Welder."

176. National Carbide Co.—Information on calcium carbide available, also name of nearest distributor.

177. National Electric Welding Machines Co.—Write for further information on National's electric multistation dial feed machine.

178. National Welding Equipment Co.—Further information on the new "Cadet Regulator" available.

179. Norris-Thermador Corp.—Write for specifications on all sizes of Norris-Thermador's acetylene cylinders.

180. Page Steel & Wire Div. Comparison Chart DH-1218; Submerged arc and inert gas welding wire folder DH-402A and gas welding rod booklet DH-1277 are all available.

181. Phoenix Products Co.—Literature available on the latest rod-drying mehtods, "Dry Rod as Standard Welding Equipment."

182. Picker X-Ray Corp.—Further information available on Picker radiography.

183. Pressed Steel Tank Co.—Write for detailed facts and prices on Hackney high pressure gas cylinders.

184. Rankin Mfg. Co.—Ranite Select-O-Graph Guide available.

185. Shoot-A-Lite Corp.—Literature on "Safety Gas Liter" for welding and cutting torches.

186. Singer Glove Mfg. Co.—Catalog available on Singer's safety clothing and gloves.

187. A. O. Smith Corp.—Further information available on A. O. Smith welding machines.

188. Smith Welding Equipment Co.—Write for further information on Smith's repair service.

189. Square D Co.—Bulletin SM-277 explains the complete line of Square D's heavy industrial electrical equipment.

190. Stulz-Sickles Co.—Details on Bare Welding Electrodes available also name of nearest distributor.

191. Sylvania Electric Products Inc.—Information on color coded Tungsten electrodes.

192. Tempil Corp.—Write for further information on "Tempilstiks" and booklet "How Temperatures Are Measured."

193. Tennessee Fabricating Co.—Catalog showing 400 casting designs available.

194. Tillman & Co., John—Write for catalog on weldor's gloves and garments.

195. Tuffaloy Dept., Air Reduction Sales Co.—Catalog and prices on Tuffaloy spot welding tips, tip holders and adapters is available.

196. United Wire & Supply Corp.—Booklet, "Low Temperature Brazing Engineering Facts and Data."

197. Victor Equipment Co.—Further information on Victor's cutting equipment and regulators.

198. Welsh Mfg. Co.—Write for bulletin on the new Welsh "Air-Raider" respirator.

199. Westinghouse Electric Corp.—Further information on the new West-Ing-Arc Dynamic Reactor.

200. Westinghouse X-Ray Div.—Information on the full line of industrial radiographic-fluoroscopic equipment is available.

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Address_____

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51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

Opinions vary on the preferred tipping method but—

SYLVANIA
TUNGSTEN ELECTRODES
MANUFACTURED BY SYLVANIA ELECTRIC PRODUCTS INC., CHEMICAL & METALLURGICAL DIV., TOWANDA, PA., U.S.A.

most welders agree on the preferred electrode

Welders say they prefer Sylvania Tungsten Electrodes because they tip easily and economically. Now Sylvania packs money-saving information on tipping with every package of welding electrodes. The leaflet "How to Avoid Waste" presents methods for proper re-tipping which are the results of experience and research.

It's just one more reason why, more than ever, welders prefer Sylvania electrodes and why your welding supply distributor is happy to serve you with the industry's only complete line.

Remember too, that for further protection against waste, Sylvania electrodes are color-coded and packed in a protective wood filler.

Ask your distributor for Sylvania next time you order.

TUNGSTEN • MOLYBDENUM • CHEMICALS • PHOSPHORS • SEMICONDUCTORS

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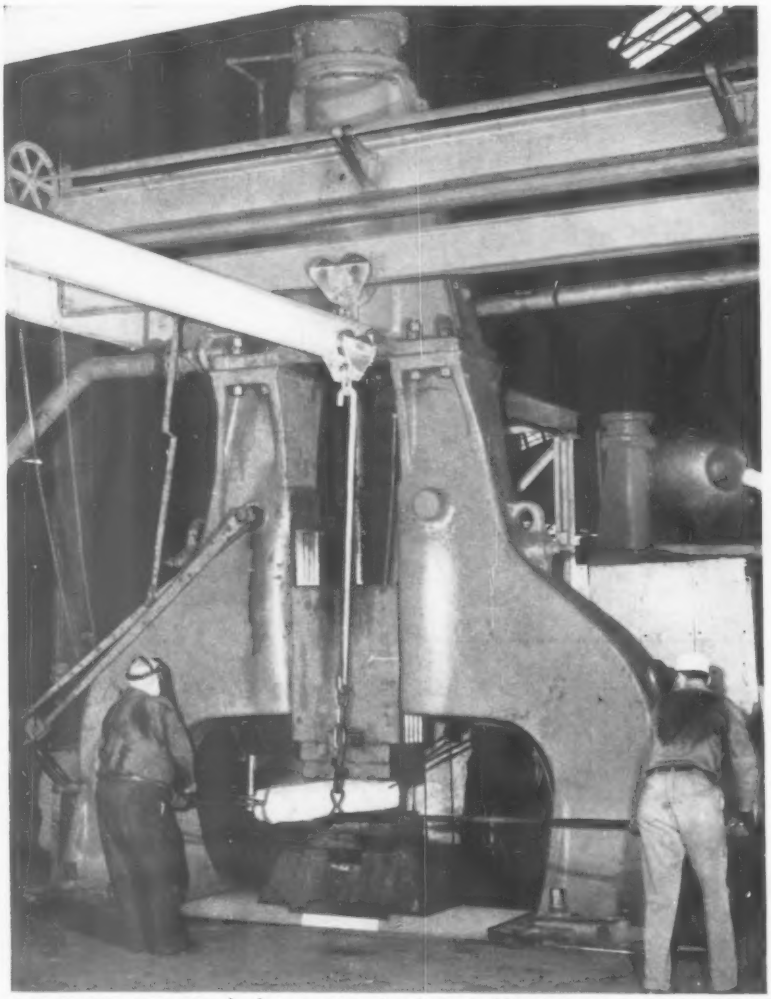
Sylvania Electric Products Inc.
Chemical & Metallurgical Div.
Towanda, Penna.

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • CHEMISTRY-METALLURGY

RECORD BRAZE-WELDING REPAIR ON 60-TON HAMMER BASE PREVENTS 8 MONTHS' LOSS OF PRODUCTION



8,000-LB. FORGING HAMMER back in service after braze-welding repairs to its 120,000-lb. anvil, which extends 8 feet below floor level. Color shows location of repair weld.

WHEN the 60-ton, semi-steel base of a big forging hammer at the Jessop Steel Co., Washington, Penn., fractured, management had to make a quick decision. Ordering a new base meant that the hammer would stand idle approximately nine months. Consultation with Maintenance Engineering Corp., of Pittsburgh, specialists in the repair of heavy machinery, showed that the base could be repaired by braze-welding at a big saving in time and money.

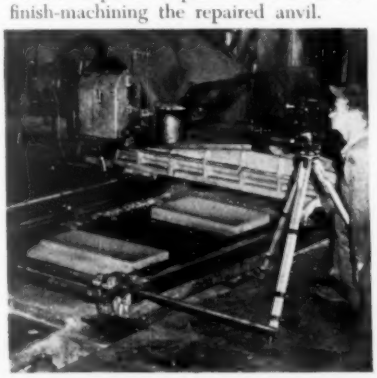
Maintenance Engineering got the go-ahead and completed the weld in one week*—a saving of eight months' production time—*at 20% of replacement cost.* "We are very pleased with the savings in down time and cash," says Mr. H. K. Taylor, Vice President in Charge of Operations of Jessop Steel Co. "The hammer has been back in service now for over six months and the braze metal is just an integral part of the base."

**Including preparation, machining and welding—total of 3 weeks.*

Always consider braze-welding repair. No matter how bad or how big the break in industrial equipment, it pays to investigate the advantages of repairing it by braze-welding. The savings possible in production time and cost are often surprising. Oxyacetylene braze-welding with Anaconda-997 (Low Fuming) Bronze and Tobin Bronze*-481 Welding Rods is receiving increasing recognition as the easiest and least expensive method of making strong, lasting repairs. For more information and technical assistance on your welding problems, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 58166

ANACONDA®
WELDING RODS
MADE BY
THE AMERICAN BRASS COMPANY

PREPARING FRACTURED SURFACE of anvil to produce a smooth surface with overlap margin. Dotted lines show original outline.

ABOVE: Completed weld which used 2,350 lb. of Tobin Bronze-481 Welding Rod.

BELOW: A portable planer was used for finish-machining the repaired anvil.